Bruhat Bengaluru Mahanagara Palike

Road Infrastructure – East Division

23rd Floor, Netaji Subashchandra Bose Building, M.G. Road,
Bengaluru – 560001, Email: rieastdivisionbbmp@gmail.com

TENDER FOR THE WORK OF

"Construction of Elevated Rotary Flyover at IOC Junction and Construction of additional 2 Lane ROB at Baiyyappanahalli Railway Level Crossing"
on Turnkey - Lumpsum - Fixed Price - No Variation - No Escalation basis.

Amount Put to Tender: 35248.00 Lakhs

Tender Notification
(Through GOK, http://kppp.karnataka.gov.in only)

TENDER REFERENCE No	:	EE/RI/EAST/TEND/ /2023-24 Dated: 04.03.2024
TENDER DOCUMENT CAN BE DOWNLODED FROM KPPP PORTAL FROM	:	04.03.2024
PRE BID MEETING	:	14.03.2024 15.00 hours
LAST DATE AND TIME FOR RECEIPT OF TENDERS	:	04.04.2024 16.00 hours
TIME AND DATE OF OPENING OF TECHNICAL TENDERS	:	05.04.2024 16.30 hours
TIME AND DATE OF OPENING OF FINANCIAL TENDERS	:	Will be intimated to technically qualified tenderer
ADDRESS FOR COMMUNICATION	:	Office of the Executive Engineer, Road Infrastructure – East Division 23rd Floor, Netaji Subashchandra Bose Building, M.G. Road, Bengaluru – 560001, Email: rieastdivisionbbmp@gmail.com

Contents

Section No.	Description	Page No.
1	Tender notification	3-5
2	Instructions to Tenderers (ITT)	6
3	Qualification Information	19
4	Forms of Tender, Letter of Acceptance, Notice to Proceed with the Work and Agreement Form	21-24
5	Conditions of Contract (CC)	25
6	Scope of Work and Design Criteria	51
7	Contract Data	89
8	Specifications	94
9	Drawings	94
10	Format of Bank Guarantee for Performance Security	95
11	Form of Financial Bid	98
12	Technical Specifications for Steel Structures	100-178
13	MORTH Supplementary Technical Specifications	179-218

BRUHAT BENGALURU MAHANAGARA PALIKE

Office of the Executive Engineer, Road Infrastructure – East Division,
23rd Floor, Netaji Subashchandra Bose Building, M.G. Road,
Bengaluru – 560001, Email: rieastdivisionbbmp@gmail.com

No. EE/RI/EAST/TEND/04 /2023-24 Dated: 04.03.2024

Tender Notification

INVITATION FOR TENDER (IFT)

(Through http://kppp.karnataka.gov.in only)
(Two Cover System)

1. The Executive Engineer, RI-East Division, BBMP, Bengaluru invites tenders from eligible Contractors registered in Bruhat Bengaluru Mahanagara Palike or equivalent registration with CPWD / KPWD / Railways / MES / National Highway or any State Government Organizations for the construction of works detailed in the table below. The tenderers may submit tenders for works given in the table through kppp portal of the Government of Karnataka (https://eproc.karnataka.gov.in). The Tenderers are advised to note the minimum qualification criteria specified in Clause 3 of the Instructions to Tenderer's to qualify for award of the contract (Standard Tender Document – KW-4 and KTPP Act shall be followed).
2. Tenders must be accompanied by Earnest Money Deposit (EMD) specified for the work in the table below. Earnest money deposit will have to be in any one of the forms as specified in the Tender document any errors in the EMD shall be liable for rejection and shall have to be valid for 45 days beyond the validity of the tender.
3. Tenders must be submitted online through kppp portal on or before **16.00** hours on **04-04-2024** and the opening of tenders will be as per the kppp portal guidelines.
4. Tender documents and other information can be downloaded in the kppp portal from **04-03-2024.**
5. Other details can be seen in the tender documents.

Sl. No	Name of the Work	Amount put to tender (in lakhs)	EMD (in Lakhs)	Cost of Tender Document	Period of Completion
1.	**"Construction of Elevated Rotary Flyover at IOC Junction and Construction of additional 2 Lane ROB at Baiyyappanahalli Railway Level Crossing"** on Turnkey - Lumpsum - Fixed Price - No Variation - No Escalation basis.	35248.00 (Including GST)	353.00 Lakhs (Rs.1.00 Lakh through kppp portal and Rs.352.00 Lakhs in the form of BG/ e- Bank Guarantee)	**As per kppp Portal**	24 Months (Including Monsoon)

Following shall be the calendar of events for Tendering:

Availability of Tender documents	:	04-03-2024
Pre bid meeting	:	14-03-2024 16.00 hours
Last Date & Time for receipt of tenders	:	04-04-2024 16.00 hours
Date & Time for Opening of Technical Bid	:	05-04-2024 16.30 hours
Date & Time for Opening of Financial Bid	:	(Will be intimated after obtaining approval for Technical Evaluation)

Note:

A. The bid must be submitted in the electronic tendering system only. The bid containing details of their capability to undertake the tender and scope of service to be carried out, this will be considered.

B. Tender documents may be downloaded from, Government of Karnataka kppp website under login for contractors from 04.03.2024 onwards.

C. Contractor can access tender documents on the website, fill them and submit the completed tender document into electronic tender on the website after submitting the EMD and tender processing fee in the form of e-payment. EMD of the unsuccessful bidders will be refunded only after issuing LOA to the successful bidder.

D. Bidder should attach all the scanned copies of certificates pertaining to their eligibility criteria, qualification information documents, failing which the bid will not be considered. No physical documents shall be considered. (Also all scanned copies should be visible and should have clarity). IT returns and its year wise abstract should be certified by Chartered Accountant.

E. Any effort by the bidder to influence the client in the bid evaluation, bid comparison or contract award decision results in rejection of the consultants bid.

F. The Financial Bid is to be read, for the purpose of pricing, in continuation with the Instructions to Tenderers, Conditions of Contract, Scope of Work, Design Criteria, Specifications, Drawings and all other Components are Parts of the Tender Document.

G. A successful bidder will have to execute an agreement with Executive Engineer, RI - East Division, BBMP Bengaluru within 3 days upon receipt of intimation along with performance Security as per contract price in form of Bank Guarantee obtained from a Nationalized Bank / Scheduled Bank payable at Bengaluru. The work shall be commenced with all earnestness within seven days from the date of issue of work order, failing in such cases the performance security will forfeited which it would be presumed that he is not interested in the work and action will be taken to get the work executed through alternate agency.

H. The Bruhat Bengaluru Mahanagara Palike, Bengaluru reserves the right to accept / reject any or all tenders without assigning any reasons.

I. Corrigendum's / modifications / corrections, if any, will be published in the kppp website only.

J. Further details of the work of the tender can be obtained in the office of the Office of the Executive Engineer, Road Infrastructure – East Division, 23rd Floor, Netaji Subashchandra Bose Building, M.G. Road, Bengaluru – 560001, Email: rieastdivisionbbmp@gmail.com on all working days.

K. GOK kppp portal http://kppp.karnataka.gov.in for registration and e-payment details contact kppp portal Helpdesk at 080 — 22485867.

L. All drawings uploaded in the GOK kppp portal is tender purpose only mentioned elsewhere in the drawing / tender document as final and approved must be considered as tender purpose only.

Sd/-
Executive Engineer,
RI-East Division
Bruhat Bangalore Mahanagara Palike

Copy Submitted for kind information to the:

1. Personnel Assistant to Hon'ble Chief Commissioner to bring into the kind notice of The Hon'ble Chief Commissioner.
2. Special Commissioner (Projects)/ Additional Commissioner (Projects)., BBMP.
3. Engineer – in Chief BBMP for kind information.
4. Joint Commissioner East Zone for kind information.
5. Chief Engineer RI for kind information.
6. Superintending Engineer, Road Infrastructure for kind information.
7. The CAO / Chief Auditor for kind information.
8. I.T. Advisor with a Request to publish the same in the BBMP Website.
9. Public Relation Officer, BBMP to publish in two leading Newspapers in Kannada and English and also to publish the same at National Level.
10. Notice board
11. Office Copy.

Sd/-
Executive Engineer
RI - East Division
Bruhat Bangalore Mahanagara Palike

SECTION 2: INSTRUCTIONS TO TENDERERS (ITT)

Table of Clauses

A.	**General**	**Page No.**
1.	Scope of Tender	7
2.	Eligible Tenderers	7
3.	Qualification of the Tenderer	7-8
4.	One Tender per Tenderer	9
5.	Cost of Tendering	9
6.	Site Visit	10
B.	**Tender Documents**	
7.	Content of Tender Documents	11
8.	Clarification of Tender Document	11
9.	Amendment of Tender Documents	11
C.	**Preparation of Tenders**	
10.	Documents Comprising the Tender	11
11.	Tender Prices	12
12.	Tender Validity	12
13.	Earnest Money Deposit	13
14.	Format and Signing of Tender	14
D.	**Submission of Tenders**	
15.	Sealing and Marking of Tenders	14
16.	Deadline for Submission of Tenders	15
17.	Late Tenders	15
18.	Modification and Withdrawal of Tenders	15
E.	**Tender Opening and Evaluation**	
19.	Opening of First Cover of All Tenders and Evaluation to Determine Qualified Tenderers	15
20.	Opening of Second Cover Tenders of Qualified Tenders and Evaluation	15
21.	Process to be Confidential	16
22.	Clarification of Tenders	16
23.	Examination of Tenders and Determination of Responsiveness	16
24.	Correction of Errors	16
25.	Evaluation and Comparison of Tenders	17
F.	**Award of Contract**	
26.	Award Criteria	17
27.	Employer's Right to accept any Tender and to reject any or all	17
28.	Notification of Award and Signing of Agreement	17
29.	Performance Security	18
30.	Advance Payment	18
31.	Corrupt or Fraudulent Practices	18

A. General

1. Scope of Tender

1.1 The Bruhat Bangalore Mahanagara Palike (BBMP) (Referred to as Employer in these documents) invites Tenders following Two Cover Tender Procedure, from the Eligible Tenderers, for the Construction of Works (as defined in these documents and referred to as "the Works") detailed in the Invitation for Tenders (IFT). The Tenderers may submit Tenders for the same Work.

2. Eligible Tenderers

2.1 Tenderers shall not be under a Declaration of Ineligibility for Corrupt and Fraudulent Practices issued by the Government of Karnataka

2.2 Tender from Joint Ventures / Consortia are not acceptable.

2.3 Bidders of certain countries are restricted on Public Procurement and refer proceedings of the Government of Karnataka order No FD 455 Exp- 12 2020 Bengaluru dated 1/4/2023 is annexed at last in the Tender document.

3. Qualification of the Tenderer

3.1 All Tenderers shall provide the requested information accurately and in sufficient detail in Section 3: Qualification Information.

3.2 To qualify for award of this Contract, each Tenderer in its name should have in the last five years i.e. 2018 – 2019 to 2022 – 2023

a. Achieved in at least in two Financial Year a minimum Financial Turnover (in all classes of Civil Engineering Construction Works only) of **Rs. 35250.00 Lakh**. Further, the Financial Turnover of the Previous Years shall be given a Weightage of 10% per year to bring them to the Price Level of 2023 – 24.

b. Satisfactorily completed, as Prime Contractor, at least One Similar nature of Major Work involving Construction of Major Road covering at least 3000 m structural length which is cumulative length of all types of structures including major bridges, overpasses, Grade separator/flyover/ROB including approaches OR Any One project of Elevated Road with PSC /Steel Girders (should have completed not less than 90% of Contract Value) and cost of the project not less than **Rs. 28000.00 Lakh** (modified clause under b. *to an extent of 80% of the cost of the work, for all works costing more than Rs.100 lakh as per Government Order No. FD 4 PCL 2008. Bangalore. dated 14.10.2008 for KW4*) and the same shall have been opened to traffic. In support of this, the Tenderer shall furnish a Work Done Completion Certificate duly certified by the Competent Authority not below the Rank of the Executive Engineer. The Work Completion Certificate shall mention the Nature of Work, Items of Work executed, Date of Commencement and Date of Completion of the Work. Further, the Value of the Completed Works shall be given a Weightage of 10% per year to bring them to the Price Level of 2023 – 24. Also, Tenderer should attach the payment certificates obtained from the State/Central Government / OR State/Central Govt units, for proof of receipt of payment for similar nature of work.

c. Executed in one single Financial Year, the following minimum Quantities of Work.

Sl. No	Description	Unit	Quantity
1	Earth work Excavation/ Embankment/Construction median/Filling available earth	**Cum**	**26764**
2	Construction of GSB/WMM	**Cum**	**7715**
3	BM/DBM/BC	**Cum**	**3296**
4	Concrete Works of all grade	**Cum**	**26629**
5	TMT Steel	**MT**	**2404**
6	HT Strands	**MT**	**280**

d. Further, certificate of minimum 790 MT of structural steel approved/used/designed using in a single project for fabricating Steel Girders of Steel I / Box / Bowstring Girders in any State/Central Government project in operation (for work completed or On-going works) during last 3 financial years should be submitted for qualification of minimum quantities of Structural steel. The certificate should be duly issued by the competent authority not below the rank of Executive Engineer.

3.3 Each Tenderer should further demonstrate

a. Availability by owning at least 50% of the following Key and Critical Equipment for this Work and the remaining 50% can be deployed on lease / hire basis for all Works provided the relevant Documents (Commitment Agreement, etc.) for Availability for this Work are furnished.

Sl. No	Description	Requirement	Own	Hire
1	Concrete Batching Plant and allied Equipment such as Transit Mixer 4 TO 7cum capacity), Concrete Pump, Vibrator, etc. (50 cum / hr.)	2 No	1	1
2	Screed vibrators, vibrators of needle, Generator, welding set	2 No	1	1
3	Hydrostatic Paver with Sensor Control of 9m wide Arm	1 No	1	-
4	Crane 50T Capacity	2 No	-	2
5	Hydraulic Rotary Rig of minimum 1000mm diameter	2 No	-	2
	Hot Mix Plant 100 – 120 TPH Capacity	1 No	1	-
7	Portal/mobile crane of 10T capacity	1 No	1	-
8	Compressors of adequate capacity for riveting	4 No	2	2
9	Oxy-Acetylene gas cutting	4 No	2	2
10	Radial drilling machine adequate capacity to drill 50mm dia hole	4 No	2	2
11	Hitachi	6 No	3	3
12	Tippers	10 No	5	5
13	Backhoe Loaders	6 No	3	3
14	Dozers	2 No	1	1
15	Wheel loaders	2 No	-	2
16	Diamond Cutter	2 No	-	2
17	Pulverizer	2 No	-	2

b. Liquid Assets and / or availability of Credit Facilities of no less than Rs. 7138.00 Lakh (Letter of Credit from Nationalized / Scheduled Bank for meeting the Fund Requirement, etc.).

c. In the case of the death of a Contractor after executing the Agreement / Commencement of the Work, his Legal Heir, if an Eligible Registered Contractor and willing, can execute and complete the work at the accepted Tender Rates irrespective of the Cost of the Work.

3.4 Tenderers having In – house Design Office or associated with Design Firms / Consulting Firms shall furnish the Details of the Design Experience of the Tenderer or the Associating Firm in the Design of Flyover/ROB. In case the Tenderer is associating with a Design Firm / Consulting Firm, Company Profile of the Firm and Consenting Letter with Memorandum of Understanding for Association along with experience certificate in similar nature of work of design consultancy cost not less than one percent of the contract value of this tender issued by not below the rank of Executive Engineer shall be uploaded in the tender, if tenderer fails to upload the certificate such tender shall be rejected without assigning any reason.

The Employer shall have the right to verify all the Men and Machinery Details / Documents submitted by the Tenderer at any point of time during Technical Evaluation of the Tender Document.

3.5 To qualify for the Contract for which Tenders are invited in this IFT, the Tenderer must demonstrate having Experience and Resources to meet the Aggregate of the Qualifying Criteria for the Contract.

3.6 Sub Contractors' Experience and Resources shall not be taken into account in determining the Tenderers Compliance with the Qualifying Criteria.

3.7 Tenderers who meet the above specified minimum Qualifying Criteria, will only be qualified, if their available Tender Capacity is more than the total Tender Value. The available Tender Capacity will be calculated as under.

Assessed available Tender Capacity = (A*N*1.5 – B)

Where

A = Maximum Value of Civil Engineering Works executed in any One Year during the last Five years (updated to 2023 – 2024 Price Level) taking into account the Completed as well as Works in Progress.

N = Number of years prescribed for Completion of the Works for which Tenders are Invited i.e. 24 Months.

B = Value, at 2023 – 2024 Price Level on 10% Weightage per annum, of Existing Commitments and On Going Works to be completed during the next 24 months.

Note: The Statements showing the Value of Existing Commitments and On Going works as well as the Stipulated Period of Completion remaining for each of the Works Listed should be countersigned by the Employer in charge, not below the Rank of an Executive Engineer or equivalent.

3.8 Even though the Tenderers meet the above Criteria, they are subject to be disqualified if they have

- Made Misleading or False Representations in the Forms, Statements and Attachments submitted in Proof of the Qualification Requirements; and / or
- Record of Poor Performance such as Abandoning the Works, not properly completing the Contract, Inordinate Delays in Completion, Litigation History, or Financial Failures etc.; and / or
- Participated in the previous Tender for the same Work and had quoted unreasonably High Tender Prices and could not furnish rational justification.

4. One Tender per Tenderer

4.1 Each Tenderer shall submit only one Tender for the Project. A Tenderer who submits or participates in more than one Tender (other than as a Sub Contractor or in cases of alternatives that have been permitted or requested) will cause all the Proposals with the Tenderer's Participation to be disqualified.

5. Cost of Tendering

5.1 The Tenderer shall bear all Costs associated with the Preparation and Submission of his Tender, and the Employer will in no case be Responsible and Liable for those Costs.

6. Site Visit

6.1 The Tenderer shall, prior to submitting his Tender for the Work, visit and examine the Site of Works and its surroundings at his own expense and obtain and ascertain for himself on his own responsibility all information that may be necessary for preparing his Tender and entering into the Contract, including, inter alia, the actual Conditions regarding the Nature and Conditions of the Site, Availability of Materials, Labour, probable Sites for Labour Camps, Stores, etc. and the Extent of Lead and Lift required for the Work in complete form over the entire duration of the Contract, Restrictions, Obstructions in Work, if any, allow for all such Extras likely to be incurred due to any such Conditions, Restrictions, Obstructions, etc. in the quoted Tender Price for the Work.

6.2 In addition, the Tenderers shall also satisfy themselves about the following other Factors.

a. Site Conditions including Access to the Site, Existing and Required Roads and other Means of Transport / Communication for use by him in connection with the Work including Diversion and Rerouting of Services.

b. Ensuring that the Traffic Movement during the Construction of the Works is properly diverted, maintained and obstruction to the Traffic Movement is kept to the minimum during various Stages of Construction as planned and approved by the Employer. The Traffic Diversion with all Cost of Men and Materials is to be borne by the Tenderer.

c. Requirement and Availability of Land and other Facilities for his enabling Works, Colonies, Stores and Workshops, etc.

d. Ground Conditions including those bearing upon Transportation, Disposal, Handling and Storage of Materials required for the Work or obtained there from.

e. Source and Extent of Availability of Suitable Materials including Water, etc. and Labours (skilled and unskilled), required for the Work and Laws and Regulations governing their Use and Employment.

f. Geological, Meteorological, Topographical and other General Features of the Site and its Surroundings and are pertaining to and needed for the Performance of the Work.

g. The Limit and Extent of Surface and Sub Surface Water to be encountered during the Performance of the Work and the Requirement of Drainage and Pumping.

h. The Type of Equipment and Facilities needed, for and in the performance of the Work; and

i. All other Information pertaining to and needed for the Work including Information as to the Risks, Contingencies and other Circumstances, which may influence or affect the Work or the Cost thereof under this Contract.

The Tenderers shall note that Information, if any, in regard to the Local Conditions, as contained in these Tender Documents, have been provided for Guidance and is not warranted being complete.

6.3 A Tenderer shall be deemed to have full Knowledge of the Site, whether he inspects it or not, and no extra charges consequent to any misunderstanding or otherwise shall be allowed.

6.4 The Tenderer and any of his Personnel or Agents will be granted permission by the Employer or his Authorised Nominee, on receipt of Formal Application in respect thereof a Week in Advance of the Proposed Date of Inspection of Site, to enter upon the Premises and Lands for Purpose of such Inspection, but only on the Express Condition that the Tenderer shall indemnify the Employer from and against all Liability in respect thereof and the Tenderer will be responsible for Personal Injury (whether fatal or otherwise), Loss or Damage to Property and any other Loss, Damage, Costs and Expenses however caused which, but for the Exercise of such Permission, would not have arisen.

B. Tender Documents

7. Content of Tender Documents

7.1 The Tender Document shall have all the Sections given in Page 2.

8. Clarification of Tender Documents

8.1 **Refer Clause No. 8.2 below**.

8.2 **Pre Tender Meeting**

8.2.1 The Tenderer or his Authorized Representative is invited to attend a Pre Tender Meeting, which will take place at the Office of the Chief Engineer, Road Infrastructure/Engineer in Chief, No. 108, Annex-2 Building, 1st Floor, N.R. Square, Bengaluru - 560002 on 14.03.2024 at 15.00 hrs.

8.2.2 The Purpose of the Meeting will be to clarify Issues and to answer Questions on any matter that may be raised at that stage.

8.2.3 The Tenderer is requested to submit any Questions in Writing or by Cable to reach the Employer not later than 14-03-2024 up to 16. 00 hrs.

8.2.4 Minutes of the Meeting, including the Text of the Questions raised (without identifying the Source of Enquiry) and the Responses given will be displayed in the Website. Any Modification of the Tender Documents listed in Sub Clause 7.1 that may become necessary as a result of the Pre Tender Meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause 9 and not through the Minutes of the Pre Tender Meeting and the same shall be displayed in the Website.

8.2.5 Non Attendance at the Pre Tender Meeting will not be a cause for Disqualification of a Tenderer.

9. Amendment of Tender Documents

9.1 Before the Deadline for Submission of Tenders, the Employer may modify the Tender Documents by issuing Addenda.

9.2 Any Addendum thus issued shall be part of the Tender Documents and shall be displayed in the Website.

9.3 To give the Tenderers reasonable time in which to take an Addendum into account in preparing their Tenders, the Employer shall extend as necessary the Deadline for Submission of Tenders, in accordance with Sub Clause 16.2 below.

C. Preparation of Tenders

10. Documents Comprising the Tender

10.1 The Tender submitted by the Tenderers shall contain the Documents as follows.

10.1.1 **Technical Bid**

a. Earnest Money Deposit.
b. Qualification Information as per Formats given in Section 3.
c. Detailed Design and Drawings, Detailed Description of Work and Specifications of Materials and Items.
d. Initial Program showing the General Methods, Arrangements, Construction Methodology, Order and Timing for all the Activities in the Work.
e. Biodata of Proposed Technical and Managerial Staffs to be deployed at Site for the Work.
f. Number and Category of each type of Skilled Personnel to be deputed for this Work as per the Details mentioned in the Clause No. 50 of Special Condition of Contract.

g. Details of Plants and Machineries to be deployed at Site for the Work as per the Details mentioned in the Clause No. 51 of Special Condition of Contract.

h. Cash Flow Chart on month – to – month basis for the entire Period of Execution of the Work as per the Details mentioned in the Clause No. 52 of Special Condition of Contract.

i. Proposed Workshop Facility to be set up by the Tenderer as per the Details mentioned in Clause No. 53 of Special Conditions of Contract.

j. Unpriced Bill of Quantities as per the Details mentioned in Clause No. 58 of Special Conditions of Contract.

k. Report on the Aesthetic Aspect of the Structure as per the Details mentioned in Clause No. 2.3 of Section 6 – Scope of Work and Design Criteria.

10.1.2 **Financial Bid**

a. The Tender (in the Format indicated in Section 4).

b. Priced Financial Bid (Section 10); and any other Materials required be completing and submitting by the Tenderers in accordance with these Instructions. The Documents Listed under Sections 4, 7 and 10 shall be filled in without exception.

11. Tender Prices

11.1 The Contract shall be TurnKey Lump Sum Contract based on Tenderer's own Design for the Whole Works as described in Sub Clause 1.1.

11.2 The Tenderer shall fill in the Lump Sum Price (both in Figures and in Words) for the Whole Works. Corrections, if any, shall be made by crossing out, initialing, dating and rewriting.

11.3 The Price quoted by the Tenderer shall be for the Whole Works as noted in the Schedule, Specifications and elsewhere in this Document and shall hold good till the Completion of Work. They shall be inclusive of GST, all Taxes, Duties and Levies including Sales Tax, Municipal Taxes, Local Taxes, Octroi, ESI, all Royalties, Patent Rights, other Incidental Charges, etc. The Rate shall also include the Cost of all Labours, Materials, Plant, Machinery, Equipments, Carriage and other Inputs involved in the Execution and Completion of the Work.

11.4 The Contractor will have to make his own Arrangements for Water, Electricity, Place for Storage of Construction Materials, Casting Yards, Labour Camps, etc. required for Construction and shall use his own Plant and Machinery, which may be required for the Speedy Execution of the Work.

11.5 During Traffic Diversion, the Contractor shall provide necessary Signages, Signals, Lighting Arrangements, etc. The Quoted Rate shall also be inclusive of Providing Skilled Personnel for Traffic Diversion as per the Requirements of the City Traffic Police.

12. Tender Validity

12.1 Tenders shall remain valid for a period not less than one hundred and eighty (180) days after the Deadline Date for Tender Submission specified in Clause 16. A Tender valid for a Shorter Period shall be rejected by the Employer as Non Responsive.

12.2 In Exceptional Circumstances, prior to expiry of the Original Time Limit, the Employer may request that the Tenderers may extend the Period of Validity for a Specified Additional Period. The Request and the Tenderers' Responses shall be made in Writing or by Cable. A Tenderer may refuse the Request without forfeiting his Earnest Money Deposit. A Tenderer agreeing to the Request will not be required or permitted to modify his Tender, but will be required to extend the Validity of his Earnest Money Deposit for a Period of the Extension, and in compliance with Clause 13 in all respects.

13. Earnest Money Deposit

The Tenderer shall furnish, as part of his tender, Earnest Money Deposit (EMD) in the amount as mentioned in IFT for this particular Work. Further, out of the total EMD Amount of **Rs. 353.00** Lakhs only **Rs. 1.00 Lakh Rupees One Lakh only** shall be paid in the kppp portal using any of the following modes and the Balance Amount of **Rs. 352.00** lakhs may be in the **form of Bank Guarantee/e-Bank Guarantee** from any Nationalised / Scheduled Bank. Tenderer may also pay full amount of EMD of **Rs. 353.00** Lakhs using kppp portal using any of the modes mentioned below.

- Credit Card.
- Direct Debit.
- National Electronic Fund Transfer (NEFT).
- Over the Counter (OTC).

NEFT Payment Procedure

If a Tenderer chooses to make Payment of EMD / Tender Processing Fee using Reserve Bank of India's (RBI) National Electronic Fund Transfer (NEFT) System, the Tenderer will need to log into e – Procurement System, access the Tender for which Bid is being created and then select the NEFT Option under the Payment Section and print the Challan shown in that Section. The Printed Challan will have the Unique Bid Reference Number, Account Details of Government of Karnataka and the Amount to be remitted. The Tenderer shall submit the Printed Challan to its Bank Branch (NEFT enabled) and request for an Account – to – Account Transfer, wherein the money will get transferred from the Tenderer's Bank Account to GOK's Bank Account. The Tenderer shall ensure that NEFT Transfer Instructions are executed and the Funds are wired to the Government of Karnataka's Principal Account before the Last Date for Bid Submission and preferably 24 hours before the Last Date for Bid Submission. If the Tenderer's Bank transfers / wires the money after the Last Date for Bid Submission, the Tenderer's Bid will be liable for rejection. Upon executing the Transfer, the Tenderer's Bank will provide a Reference Number generated by NEFT Software as Confirmation of Transfer, which has to be input by the Tenderer in the Payment Section of its Bid as Payment Confirmation before the Bid is submitted i.e. as a pre requisite for Bid Submission. The Account Number from which the Funds were transferred shall be input in the e – Procurement System as part of its Bid also.

OTC Payment Procedure

If a Tenderer chooses to make Payment of EMD / Tender Processing Fees Over The Counter (OTC) in any of the designated Axis Bank Branches listed in the e – Procurement Website (www.eproc.karnataka.gov.in), the Tenderer will need to log into e – Procurement System, access the Tender for which Bid is being created and then select the OTC Option under the Payment Section and print the Challan shown in that Section. The Printed Challan will have the Unique Bid Reference Number and the Amount to be remitted along with the Challan. The Tenderer can choose to make the Payment either in the form of Cash or in the form of Demand Draft. Cheque Payments will not be accepted. The Tenderer is requested to specifically inform the Bank Officer to input the Unique Bid Reference Number printed in the Challan in the Banking Software. Upon successful Receipt of the Payment, the Bank will provide a 16 Digit Reference Number acknowledging the Receipt of Payment. This 16 Digit Reference Number has to be input by the Tenderer in the Payment Section of its Bid as Payment Confirmation before the Bid is submitted i.e. as a pre requisite for Bid Submission.

13.2 EMD Amount shall be submitted by the Tenderer taking into account of the following Conditions.

a. EMD for Rs. 1.00 Lakh shall be accepted only in the form of Electronic Cash (and not through Demand Draft or Bank Guarantee) and will be maintained in the Government's Central Pooling Account at Axis Bank until the Work is awarded and EMD for the Balance Amount shall be in the Form of Bank Guarantee from any Nationalised / Scheduled Bank valid for a period of not less than two hundred and twenty five (225) days after the Deadline Date for Tender Submission specified in Clause 16. Further, the Original Bank Guarantee shall be submitted to the Office of the Executive Engineer (Road Infrastructure), 23rd Floor, Netaji Subashchandra Bose Building, M.G. Road, Bengaluru – 560001, Email: rieastdivisionbbmp@gmail.com by 04 – 04 – 2024 within 16.00 hrs.

b. The Tenderer's Bid will be evaluated only on Confirmation of Receipt of the Payment of EMD as indicated in Sub Clauses 13.1 and 13.2.

13.3 Any Tender not accompanied by an acceptable EMD and not secured as indicated in Sub Clauses 13.1 and 13.2 above shall be rejected by the Employer as Non Responsive.

13.4 The Earnest Money Deposit of the Unsuccessful Tenderers will be returned within 30 days of the end of the Tender Validity Period as specified in Sub Clause 12.1.

13.5 The Earnest Money Deposit of the Successful Tenderer will be discharged only when the Tenderer has signed the Agreement and furnished the required Performance Security.

13.6 The Earnest Money Deposit may be forfeited

a. If the Tenderer withdraws the Tender after Tender Opening during the Period of Tender Validity;
b. If the Tenderer does not accept the Correction of the Tender Price, pursuant to Clause 24; or
c. In the case of a successful Tenderer, if the Tenderer fails within the specified time limit to
   i. Sign the Agreement; or
   ii. Furnish the required Performance Security.

14. Format and Signing of Tender

14.1 The Electronic Tendering System for the Construction of Work comprises of two Stages (i) Technical Bid and (ii) Financial Bid. The Tenderers are required to submit the Tender Documents in two stages electronically.

14.2 The Tender shall contain no Alterations or Additions, except those to comply with instructions issued by the Employer that are duly incorporated.

14.3 Each Page uploaded shall be duly signed and sealed by the Tenderer or a Person or Persons duly authorised to s ign on behalf of the Tenderer. Such Authorisation shall be indicated by a Written Power – of – Attorney accompanying the Tender. The Corrections, if any, shall be made by striking of and shall be initialed with date.

D. Submission of Tenders

15. Sealing and Marking of Tenders

15.1 The Tenderer shall access Tender Documents, fill them and submit the Completed Tender Document as stated in Clause 10 through Website of e – Procurement itself (http://kppp.karnataka.gov.in). The Signed, Sealed and Scanned Copy of all the Documents as stated in Clause 10 shall be attached to the e – Tender Document, failing which the Bid will not be considered. It is the Responsibility of the Tenderer to submit all the Documents pertaining to Eligibility Criteria / Qualification Information / Design Details with due diligence. All the Pages of

the Document shall be serially numbered with an Index for ready reference.

15.2 No Physical Documents shall be considered. However, all the participating Tenderers shall produce all the Original Documents / Hard Copy of the Scanned Documents uploaded in the Portal for Verification whenever asked by the Employer.

16. Deadline for Submission of the Tenders

16.1 Tenders must be received by the Employer at the Website Address specified above no later than 04-04-2024 upto 16.00 hrs.

16.2 The Employer may extend the Deadline for Submission of Tenders by issuing an Amendment in accordance with Clause 9, in which case all Rights and Obligations of the Employer and the Tenderers previously subject to the Original Deadline will then be subject to the New Deadline.

17. Late Tenders

17.1 Any Tenderer trying to submit the Tender after Deadline will not be accepted in the e – Procurement.

18. Modification and Withdrawal of Tenders

18.1 Tenderers may modify Contents of Technical Bid or Financial Bid before the Deadline prescribed in Clause 16.

18.2 Tenderers may withdraw their Tenders by canceling his Bid on the Website only before the Deadline prescribed in Clause 16.

18.3 No Tender may be modified and withdrawn after the Deadline for Submission of Tenders.

18.4 Withdrawal or Modification of a Tender between the Deadline for Submission of Tenders and the Expiration of the Original Period of Tender Validity specified in Clause 12.1 above or as extended pursuant to Clause 12.2 may result in the Forfeiture of the Earnest Money Deposit pursuant to Clause 13.

18.5 Tenderers may only offer Discounts to, or otherwise modify the Prices of their Tenders by submitting Tender Modifications in accordance with this Clause, or include in the Original Tender Submission.

E. Tender Opening and Evaluation

19. Opening of Technical Bid of all Tenders and Evaluation to determine Qualified Tenderers

19.1 The Employer will open the Technical Bids of all the Tenders received in the presence of the Tenderers or their Representatives who choose to attend at 16.30 hrs. on 05– 04 – 2024 at Office of the Executive Engineer, Road Infrastructure East Division, 23rd Floor, Netaji Subashchandra Bose Building, M.G. Road, Bengaluru – 560001, Email: rieastdivisionbbmp@gmail.com In the event of the Specified Date of Tender Opening being declared a Holiday for the Employer, the Tenders will be opened at the Appointed Time and Location on the Next Working Day.

19.2 The Tenderers' Names, the Presence or Absence of Earnest Money Deposit (Amount, Format and Validity), the Submission of Qualification Information and such other Information as the Employer may consider Appropriate will be announced by the Employer at the Opening.

19.3 The Employer shall prepare Minutes of the Tender Opening, including the Information Disclosed to those present in accordance with Sub Clause 19.2.

19.4 The Employer will evaluate and determine whether each Tender (a) is accompanied by the Required Earnest Money Deposit as per stipulations in ITT Clause 13.1 and (b) meets the Minimum Qualification Criteria stipulated in ITT Clause 3 and (c) contains the Tenderer's Designs and Drawings on the basis of the Parameters fixed in the Tender Document. The Employer will draw out a List of Qualified Tenderers.

20. Opening of Financial Bids of the Qualified Tenderers and Evaluation

20.1 The Employer will inform all the Qualified Tenderers the Time, Date and Venue fixed for the Opening of the Financial Bid containing the Priced Financial Bid. The Employer will open the Priced Financial Bids of Qualified

Tenderers at the Appointed Time and Date in the presence of the Tenderers or their Representatives who choose to attend. In the event of the Specified Date of Financial Bid Opening being declared a Holiday for the Employer, the Financial Bid will be opened at the Appointed Time and Location on the Next Working Day.

20.2 The Tenderers' Names, the Tender Prices, the Total Amount of each Tender, any Discounts, and such other Details as the Employer may consider Appropriate, will be announced by the Employer at the opening. No Tender shall be rejected at Tender Opening.

20.3 The Employer shall prepare Minutes of the Priced Financial Bid Opening, including the Information disclosed to those present in accordance with Sub Clause 20.2.

21. Process to be Confidential

21.1 Information relating to the Examination, Clarification, Evaluation, and Comparison of Tenders and Recommendations for the Award of a Contract shall not be disclosed to Tenderers or any other persons not officially concerned with such Process until the Award to the Successful Tenderer has been announced. Any effort by a Tenderer to influence the Employer's Processing of Tenders or Award Decisions may result in the Rejection of his Tender.

22. Clarification of Tenders

22.1 To assist in the Examination, Evaluation and Comparison of Tenders, the Employer may, at his discretion, ask any Tenderer for Clarification of his Tender, including Breakdowns of Unit Rates. The Request for Clarification and the Response shall be in Writing or by Cable, but no change in the Price or Substance of the Tender shall be sought, offered, or permitted except as required to confirm the Correction of Arithmetic Errors discovered by the Employer in the evaluation of the Tenders in accordance with Clause 24.

22.2 Subject to Sub Clause 22.1, no Tenderer shall contact the Employer on any Matter relating to its Tender from the time of the Tender Opening to the Time the Contract is awarded. If the Tenderer wishes to bring Additional Information to the Notice of the Employer, it should do so in Writing.

22.3 Any effort by the Tenderer to influence the Employer in the Employer’s Tender Evaluation, Tender Comparison or Contract Award Decisions may result in the rejection of the Tenderers’ Tender.

23. Examination of Tenders and Determination of Responsiveness

23.1 Prior to the Detailed Evaluation of Tenders, the Employer will determine whether each Tender; (a) has been properly signed; and (b) is substantially Responsive to the Requirements of the Tender Documents.

23.2 A Substantially Responsive Tender is one which conforms to all the Terms, Conditions and Specifications of the Tender Documents, without Material Deviation or Reservation. A Material Deviation or Reservation is one (a) which affects in any Substantial Way the Scope, Quality or Performance of the Works; (b) which limits in any Substantial Way, inconsistent with the Tender Documents, the Employer's Rights or the Tenderer's Obligations under the Contract; or (c) whose Rectification would affect Unfairly the Competitive Position of other Tenderers presenting Substantially Responsive Tenders.

23.3 If a Tender is not Substantially Responsive, it will be rejected by the Employer, and may not subsequently be made responsive by Correction or Withdrawal of the Non Conforming Deviation or Reservation.

24. Correction of Errors

24.1 Tenders determined to be Substantially Responsive will be checked by the Employer for any Arithmetic Errors. Errors will be corrected by the Employer as follows.

(a) Where there is a Discrepancy between the Rates in Figures and in Words, the lower of the two will govern.

24.2 The Amount stated in the Tender will be adjusted by the Employer in accordance with the above Procedure for the Correction of Errors and, with the Concurrence of the Tenderer, shall be considered as binding upon the Tenderer. If the Tenderer does not accept the Corrected Amount the Tender will be rejected, and the Earnest Money Deposit may be forfeited in accordance with Sub Clause 13.6 (b).

25. Evaluation and Comparison of Tenders

25.1 The Employer will evaluate and compare only the Tenders determined to be Substantially Responsive in accordance with Clause 23.

25.2 In evaluating the Tenders, the Employer will determine for each Tender the evaluated Tender Price by adjusting the Tender Price as follows.

a. Making any Correction for Errors pursuant to Clause 24 and
b. Making Appropriate Adjustments to reflect Discounts or other Price Modifications offered in accordance with Sub Clause 18.5.

25.3 The Employer reserves the right to accept or reject any Variation, Deviation or Alternative Offer. Variations, Deviations and Alternative Offers and other Factors, which are in excess of the requirements of the Tender Documents or otherwise result in Unsolicited Benefits for the Employer, shall not be taken into account in Tender Evaluation.

25.4 Deleted.

25.5 If the Tender of the Successful Tenderer is seriously Unbalanced in relation to the Employer's Estimate of the Cost of the Work to be performed under the Contract, the Employer may require the Tenderer to produce Detailed Price Analyses for any or all Items of the Financial Bid, to demonstrate the Internal Consistency of those Prices with the Construction Methods and Schedule Proposed. After Evaluation of the Price Analyses, the Employer may require that the Amount of the Performance Security set forth in Clause 29 be increased at the expense of the Successful Tenderer to a level sufficient to protect the Employer against Financial Loss in the event of Default of the Successful Tenderer under the Contract.

F. Award of Contract

26. Award Criteria

26.1 Subject to Clause 27, the Employer will award the Contract to the Tenderer whose Tender has been determined to be Substantially Responsive to the Tender Documents and who has offered the Lowest Evaluated Tender Price, provided that such Tenderer has been determined to be Eligible in accordance with the Design and Drawings submitted by the Tenderer as per the Scope of Work, Design Criteria (as detailed in Section 6) and Tender Drawings as Criteria.

27. Employer's Right to accept any Tender and to reject any or all Tenders

27.1 Notwithstanding Clause 26, the Employer reserves the right to accept or reject any Tender, and to cancel the Tender Process and reject all Tenders, at any time Prior to the Award of Contract, without thereby incurring any Liability to the Affected Tenderer or Tenderers or any Obligation to inform the Affected Tenderer or Tenderers of the Grounds for the Employer's Action.

28. Notification of Award and Signing of Agreement

28.1 The Tenderer whose Tender has been accepted will be notified of the Award by the Employer prior to Expiration of the Tender Validity Period by Cable, Telex, e – mail or Facsimile confirmed by Registered Letter. This Letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the Sum that the Employer will pay the Contractor in consideration of the Execution, Completion and Maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

28.2 The Notification of Award will constitute the Formation of the Contract, subject only to the furnishing of Security Deposit in accordance with the provisions of Clause 29.

28.3 The Agreement will incorporate all Agreements between the Employer and the Successful Tenderer. It will be kept ready for Signature of the Successful Tenderer in the Office of Employer within 20 days following the Notification of Award along with the Letter of Acceptance. Within 20 days of Receipt, the Successful Tenderer

will sign the Agreement and deliver it to the Employer.

28.4 Upon furnishing by the Successful Tenderer the Performance Security, the Employer will promptly notify the other Tenderers that their Tenders have been unsuccessful.

29. Performance Security

29.1 Within 20 days of receipt of the Letter of Acceptance, the Successful Tenderer shall deliver to the Employer a Performance Security in any of the forms given below for an Amount equivalent to 5% of the Contract Price plus Additional Security for Unbalanced Tenders in accordance with Sub Clause 25.5 of ITT and Clause 43 of the Conditions of Contract.

- Banker's Cheque / Demand Draft / Pay Order in favor of The Chief Commissioner, BBMP, Bangalore payable at Bangalore or
- Bank Guarantee in the Form given in Section 11.
- Specified Small Saving Instruments pledged to The Commissioner, BBMP, Bangalore.

29.2 If the Security Deposit is provided by the Successful Tenderer in the form of a Bank Guarantee, it shall be issued either by a Nationalized / Scheduled Bank.

29.3 The Security Deposit if furnished in Demand Draft can, if requested, be converted to Interest Bearing Securities at the Cost of the Contractor.

29.4 Failure of the Successful Tenderer to comply with the Requirements of Sub Clause 29.1 shall constitute Sufficient Grounds for Cancellation of the Award and Forfeiture of the Earnest Money Deposit.

29.5 The Security Deposit will be discharged in the Stages as mentioned in **Clause 65 of Special Conditions of Contract**.

30. Advance Payment

30.1 The Employer will provide an Advance Payment on the Contract Price as stipulated in the Conditions of Contract, subject to the Maximum Amount as stated in Contract Data.

31. Corrupt or Fraudulent Practices

31.1 The Employer requires that the Tenderers / Suppliers / Contractors, observe the Highest Standard of Ethics during the Procurement and Execution of such Contracts. In pursuance of this Policy, the Employer

a. Will reject a Proposal for Award if it determines that the Tenderer recommended for Award has engaged in Corrupt or Fraudulent Practices in competing for the Contract in Question.
b. Will declare a Firm Ineligible, either Indefinitely or for a Stated Period of Time, to be awarded a BBMP Contract if it at any time determines that the Firm has engaged in Corrupt or Fraudulent Practices in competing for, or in executing, a GOK Contract.

31.2 Furthermore, Tenderers shall be aware of the Provision stated in Sub Clause 50.2 of the Conditions of Contract.

SECTION 3: QUALIFICATION INFORMATION

The information to be filled in by the Tenderer hereunder will be used for purposes of computing Tender Capacity as provided for in Clause 3 of the Instructions to Tenderers. This information will not be incorporated in the Contract.

1.1 Constitution or Legal Status of Tenderer [Attach Copy]

Place of Registration [Attach Copy]

Principal Place of Business

1.2 Total Value of Civil Engineering Construction Works executed and Payments received in the last five years (in Rs. Lakh)

[Attach Certificate from Chartered Accountant]

2018 – 19_____
2019 – 20_____
2020– 21 _____
2021 – 22 _____
2022 – 23 _____

1.3 Work performed as Prime Contractor (in the same name) on Works of Similar Nature over during the Five Years specified in 1.2 above.

Project Name	Name of Employer	Description of Work	Contract Number	Value of Contract in Rs. Lakh	Date of Issue of Work Order	Specified Period of Completion	Actual Date of Completion	Remarks explaining Reasons for Delay in Completion of Work
1	2	3	4	5	6	7	8	9

1.4 Quantities of Work Executed as Prime Contractor (in the same name) during the Last Five Years specified in 1.2 above.

Year	Name of Work	Name of Employer	Quantity of Work Performed[1]				Remarks (Indicate Contract Reference)
			Earthwork Excavation (cum)	Concrete (cum)	Reinforcement Steel (MT)	Asphalt (cum)	
2018 – 19							
2019 – 20							
2020 – 21							
2021– 22							
2022 – 23							

[1] Items of Work for which Data is requested should tally with that specified in ITT Clause 3

1.5 Information on Works for which Tenders have been submitted and Works which are yet to be Completed as on the Date of this Tender.

(A) Existing Commitments and On Going Works

Description of Work	Place and State	Contract No. and Date	Name and Address of the Employer	Value of Contract (Rs. Lakh)	Stipulated Period of Completion	Value of Works[2] remaining to be Completed (Rs. Lakh)	Anticipated Date of Completion
1	2	3	4	5	6	7	8

[2] Attach Certificates from Engineer – in – Charge.

(B) Works for which Tenders already submitted

Description of Work	Place and State	Name and Address of the Employer	Estimated Value of Works (Rs. Lakh)	Stipulated Period of Completion	Date when Decision is Expected	Remarks, if any
1	2	3	4	5	6	7

1.6. The following Items of Equipment are considered Essential for successfully carrying out the Works. The Tenderer should furnish all the information listed below.

Item of Equipment	Requirement[3]			Owned and Available		Remarks
	No.	Capacity	Owned	No. / Capacity	Age / Condition	

[3] The Item of Equipment, Required Number and Capacity should match with those specified in ITT Clause 3.3 (a).

1.7 Reports on the Financial Standing of the Tenderer, such as Profit and Loss Statements and Auditor's Reports for the last Five Years.

1.8 Qualification and Experience of the Key Technical and Management Personnel in Permanent Employment with the Tenderer and those that are proposed to be Deployed on this Contract, if awarded.

1.9 Name, Address, Telephone, Telex and Fax Numbers of the Tenderers' Bankers who may provide References if contacted by the Employer.

1.10 Evidence of Access to Financial Resources to meet the Qualification Requirement specified in ITT Clause 3.3 (b): Letter of Credit. List them below and attach Certificate from the Banker in the suggested Format as under.

SECTION 4: FORMS OF TENDER, LETTER OF ACEPTANCE, NOTICE TO PROCEED WITH THE WORK AND AGREEMENT FORM

Form of Tender

Description of the Works: **"Construction of Elevated Rotary Flyover at IOC Junction and Construction of additional 2 Lane ROB at BaiyyappanahalliRailway Level Crossing"** on Turnkey - Lumpsum - Fixed Price - No Variation - No Escalation basis.

To
Executive Engineer,
Road Infrastructure East Division,
23rd Floor, Netaji Subashchandra Bose Building,
M.G. Road, Bengaluru – 560001,
Email: rieastdivisionbbmp@gmail.com.

Dear Sir

We _____ offer to construct and maintain during the Defects Liability Period and Maintenance Period the Works described above in accordance with the Terms and Conditions, Scope of Work, Conditions of Contract accompanying this Tender for the Lump Sum Fixed No Variation Contract Price of _____ [in figures] (_____) [in letters].[1]

This Tender and your Written Acceptance of it shall constitute a Binding Contract between us. We understand that you are not bound to accept the lowest or any Tender you receive.

We undertake that, in competing for (and, if the award is made to us, in executing) the above contract, we will strictly observe the Laws against Fraud and Corruption in Force in India namely "Prevention of Corruption Act 1988".

We hereby confirm that this Tender complies with the Tender Validity and Earnest Money Deposit required by the Tender Documents.

We attach herewith our Current Income Tax Clearance Certificate.

Yours faithfully
Authorized Signature:

Name and Title of Signatory:
Name of Tenderer:
Address:

[1] To be filled in by the Tenderer, together with his Particulars and Date of Submission at the Bottom of the Form of Tender.

Letter of Acceptance
(Letter Head Paper of the Employer)

Date:

To: [Name and Address of the Contractor]

Dear Sirs

This is to notify you that your Tender dated _____ for execution of the **"Construction of Elevated Rotary Flyover at IOC Junction and Construction of additional 2 Lane ROB at aiyyappanahalli Railway Level Crossing"** on Turnkey - Lumpsum - Fixed Price - No Variation - No Escalation basis for the Contract Price of Rupees (_____) [amount in both Words and Figures], as corrected and modified in accordance with the Instructions to Tenderers is hereby accepted by us.

You are hereby requested to furnish Security Deposit plus Additional Security for Unbalanced Tenders in Terms of Sub Clause 25.5 of ITT, in the form detailed in Clause No. 29.1 of ITT for an amount of Rs. _____ within 20 days of the Receipt of this Letter of Acceptance valid upto 30 days from the Date of Expiry of Maintenance Period of 36 months i.e. upto _____ and sign the Contract, failing which action as stated in Clause No. 29.4 of ITT will be taken.

Yours faithfully

Authorized Signature

Name and Title of Signatory

Name of Agency

Issue of Notice to Proceed with the Work

(Letter Head of the Employer)

Date:

To: [Name and Address of the Contractor]

Dear Sirs

Pursuant to your furnishing the requisite Security Deposit as stipulated in ITT Clause 29.1 and signing of the Contract Agreement for the **"Construction of Elevated Rotary Flyover at IOC Junction and Construction of additional 2 Lane ROB at Baiyyappanahalli Railway Level Crossing"** on Turnkey - Lumpsum - Fixed Price - No Variation - No Escalation basis.

. for a Tender Price of Rs. _____, you are hereby instructed to proceed with the execution of the said works in accordance with the Contract Documents.

Yours faithfully

(Signature, Name and Title of Signatory authorized to sign on behalf of Employer)

Agreement Form

This Agreement, made on the _____ day of _____ 20___, between _____ [Name and Address of Employer] (hereinafter called "the Employer") of the one part and _____ [Name and Address of Contractor] (hereinafter called "the Contractor") of the other part.

Whereas the Employer is desirous that the Contractor execute **"Construction of Elevated Rotary Flyoverat IOC Junction and Construction of additional 2 Lane ROB at Baiyyappanahalli Railway Level Crossing"** on Turnkey - Lumpsum - Fixed Price - No Variation - No Escalation basis.
(hereinafter called "the Works") and the Employer has accepted the Tender by the Contractor for the execution and completion of such Works and the remedying of any defects therein at a Contract Price of Rupees _____.

NOW THIS AGREEMENT WITNESSETH as follows.

1. In this Agreement, Words and Expression shall have the same Meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to, and they shall be deemed to form and be read and construed as part of this Agreement.
2. In consideration of the Payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any Defects therein in conformity in all aspects with the Provisions of the Contract.
3. The Employer hereby covenants to pay the Contractor in consideration of the Execution and Completion of the Works and Remedying the Defects wherein the Contract Price or such other Sum as may become payable under the Provisions of the Contract at the times and in the manner prescribed by the Contract.
4. The following Documents shall be deemed to form and be read and construed as part of this Agreement, viz.
   i. Letter of Acceptance.
   ii. Notice to proceed with the Works.
   iii. Contractor's Tender.
   iv. Contract Data.
   v. Conditions of Contract (including Special Conditions of Contract).
   vi. Specifications.
   vii. Drawings.
   viii. Financial Bid.
   ix. Minutes of Meeting of Pre Tender Meeting and
   x. Any other Document listed in the Contract Data as forming part of the Contract.

In witness whereof the Parties thereto have caused this Agreement to be executed the day and year first before written.

The Common Seal of _____
was hereunto affixed in the Presence of
Signed, Sealed and Delivered by the said _____
in the Presence of:
Binding Signature of Employer _____
Binding Signature of Contractor _____

SECTION 5: CONDITIONS OF CONTRACT

Table of Contents

A.	**General**	**Page No.**
1.	Definitions	27
2.	Interpretation	28
3.	Law Governing Contract	28
4.	Employer's Decisions	28
5.	Delegation	28
6.	Communications	28
7.	Subcontracting	28
8.	Other Contractors	28
9.	Personnel	28
10.	Employer's and Contractor's Risks	29
11.	Employer's Risks	29
12.	Contractor's Risks	29
13.	Insurance	29
14.	Site Investigation	30
15.	Queries about Contract Data	30
16.	Contractor to construct the Works	30
17.	The Works to be completed by Intended Completion Date	30
18.	Approvals by the Employer	30
19.	Safety	30
20.	Discoveries	30
21.	Possession of the Site	30
22.	Access to the Site	30
23.	Instructions	30
24.	Procedure for Resolution of Disputes	30
B.	**Time Control**	
25.	Program	31
26.	Extension of the Intended Completion Date	31
27.	Delays ordered by the Employer	31
28.	Management Meetings	31
C.	**Quality Control**	
29.	Identifying Defects	31
30.	Tests	31
31.	Correction of Defects	31
32.	Uncorrected Defects	32
D.	**Cost Control**	
33.	Financial Bid	32
34.	Variations	32
35.	Payment for Variations	32
36.	Submission of Bills for Payment	32
37.	Payments	32
38.	Compensation Events	32
39.	Tax	32
40.	Price Adjustment	32
41.	Liquidated Damages	33
42.	Advance Payments	33

43. Securities 33
44. Cost of Repairs 33

E. Finishing of Contract
45. Completion 33
46. Taking Over 33
47. Final Account 33
48. As Built Drawings 33
49. Termination 33
50. Payment upon Termination 34
51. Property 34
52. Release from Performance 34

F. Special Conditions of Contract 35

Conditions of Contract

A. General

1. Definitions

1.1 Terms which are defined in the Contract Data are not also defined in the Conditions of Contract but keep their Defined Meanings. Bold Letters are used to identify Defined Terms.

Financial Bid means the Priced and Completed Financial Bid forming part of the Tender.

Compensation Events are those defined in Clause 38 hereunder.

The **Completion Date** is the Date of Completion of the Works as certified by the Employer in accordance with Sub Clause 46.1.

The **Contract** is the Contract between the Employer and the Contractor to execute, complete and maintain the Works. It consists of the Documents listed in Clause 2.2 below.

The **Contract Data** defines the Documents and other Information, which comprise the Contract.

The **Contractor** is a Person or Corporate Body who's Tender to carry out the Works has been accepted by the Employer.

The **Contractor's Tender** is the Completed Tender Document submitted by the Contractor to the Employer.

The **Contract Price** is the Price stated in the Letter of Acceptance.

Days are Calendar Days; **Months** are Calendar Months.

A **Defect** is any Part of the Works not completed in accordance with the Contract.

The **Defects Liability Period** is the Period named in the Contract Data and calculated from the Completion Date.

The **Employer** is the Party or his Representative who will employ the Contractor to carry out the Works.

Equipment is the Contractor's Machinery and Vehicles brought temporarily to the Site to construct the Works.

The **Initial Contract Price** is the Contract Price listed in the Employer's Letter of Acceptance.

The **Intended Completion Date** is the Date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the Contract Data. The Intended Completion Date may be revised only by the Employer by issuing an Extension of Time.

Materials are all Supplies, including Consumables, used by the Contractor for incorporation in the Works.

Plant is any Integral Part of the Works which is to have a Mechanical, Electrical, Electronic or Chemical or Biological Function.

The **Site** is the Area defined as such in the Contract Data.

Specification means the Specification of the Works included in the Contract and any Modification or Addition made or approved by the Employer.

The **Start Date** is given in the Contract Data. It is the date when the Contractor shall commence Execution of the Works. It does not necessarily coincide with any of the Site Possession Dates.

A **Subcontractor** is a Person or Corporate Body who has a Contract with the Contractor to carry out a Part of the Work in the Contract which includes Work on the Site.

A **Variation** is an Instruction given by the Employer which varies the Works.

The **Works** are what the Contract requires the Contractor to construct, install, and turn over to the Employer, as defined in the Contract Data.

2. Interpretation

2.1 In interpreting these Conditions of Contract, Singular also means Plural, Male also means Female or Neuter, and the other way around. Headings have no Significance. Words have their Normal Meaning under the Language of the Contract unless specifically defined. The Employer will provide Instructions clarifying Queries about the Conditions of Contract.

2.2 The Documents forming the Contract shall be interpreted in the following Order of Priority.

i. Agreement.

ii. Letter of Acceptance, Notice to proceed with the Works.

iii. Contractor's Tender.

iv. Contract Data.

v. Conditions of Contract.

vi. Specifications.

vii. Drawings.

viii. Financial Bid.

ix. Minutes of Meeting of Pre Tender Meeting and

x. Any other Documents listed in the Contract Data as forming Part of the Contract.

3. Law Governing Contract

3.1 The Law Governing the Contract is the Laws of India supplanted by the Karnataka Local Acts.

4. Employer's Decisions

4.1 Except where otherwise specifically stated, the Employer will decide Contractual Matters between the Employer and the Contractor.

5. Delegation

5.1 The Employer may delegate any of his Duties and Responsibilities to other people after notifying the Contractor and may cancel any Delegation after notifying the Contractor.

6. Communications

6.1 Communications between Parties which are referred to in the Conditions are effective only when in writing. A Notice shall be effective only when it is delivered (in terms of Indian Contract Act).

7. Subcontracting

Deleted.

8. Other Contractors

8.1 The Contractor shall cooperate and share the Site with other Contractors, Public Authorities, Utilities and the Employer.

9. Personnel

9.1 The Contractor shall employ the Technical Personnel (of Number and Qualifications) as may be stipulated by the Employer from time to time during the Execution of the Work. The Technical Staff so employed shall be available at Site as may be stipulated by the Employer.

9.2 If the Employer asks the Contractor to remove a person who is a member of the Contractor's Staff or his Work Force stating the Reasons, the Contractor shall ensure that the Person leaves the Site within Seven Days and has no further Connection with the work in the Contract.

10. Employer's and Contractor's Risks

10.1 The Employer carries the Risks which this Contract states are Employer's Risks, and the Contractor carries the Risks which this Contract states are Contractor's Risks.

11. Employer's Risks

11.1 The Employer is responsible for the Excepted Risks, which are

a. Rebellion, Riot Commotion or Disorder unless solely restricted to Employees of the Contractor or his Sub Contractors arising from the Conduct of the Works; or

b. Deleted; or

c. Any Operation of the Forces of Nature (in so far as it occurs on the Site) which an Experienced Contractor

i. Could not have reasonably foreseen; or

ii. Could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following Measures

- Prevent Loss or Damage to Physical Property from occurring by taking Appropriate Measures or
- Insure against such Loss or Damage.

12. Contractor's Risks

12.1 All Risks of Loss or Damage to Physical Property and of Personal Injury and Death, which arise during and in consequence of the performance of the Contract other than the Excepted Risks, are the Responsibility of the Contractor.

12.2 A Cause due solely to the Contractor's Design.

13. Insurance

13.1 The Contractor shall prior to commence the works, effect and thereafter maintain Insurances, in the Joint Names of the Employer and the Contractor (cover from the First Working Day after the Start Date to the End of Defects Liability Period) in the Amounts stated in the Contract Data:

a. For Loss or Damage to the Works, Plants and Materials and the Contractor's Equipment;

b. For Liability of both Parties for Loss, Damage, Death and Injury to Third Parties or their Property arising out of the Contractor's Performance of the Contract including the Contractor's Liability for Damage to the Employer's Property other than the Works and

c. For Liability of both Parties and of any Employer's Representative for Death and Injury to the Contractor's Personnel except to the Extent that Liability arises from the Negligence of the Employer, any Employer's Representative or their Employees.

13.2 Policies and Certificates for Insurance shall be delivered by the Contractor to the Employer for his Approval before the Start Date. All such Insurances shall provide for Compensation to be payable to rectify the Loss or Damage incurred. All Payments received from Insurers relating to Loss or Damage shall be held jointly by the Parties and used for the Repair of the Loss or Damage or as Compensation for Loss or Damage that is not to be repaired.

13.3 If the Contractor fails to effect or keep in force any of the Insurances referred to in the previous Sub Clauses or fails to provide Satisfactory Evidence, Policies or Receipts, the Employer may without Prejudice to any other Right or Remedy, effect Insurance for the Cover relevant to such Default and pay the Premiums due and recover the same as a Deduction from any other Monies due to the Contractor. If no Payment is due, the Payment of the Premiums shall be a Debt Due.

13.4 Alterations to the Terms of Insurance shall not be made without the Approval of the Employer.

13.5 Both Parties shall comply with any Conditions of the Insurance Policies.

14. Site Investigation Report

14.1 The Bidders, in preparing the Tender, shall rely on any site investigation reports referred to in the contract data, supplemented by any information available to the Bidder.

15. Queries about Contract Data

15.1 The Employer will clarify queries on the contract Data

16. Contractor to construct the Works

16.1 The Contractor shall construct the Works in accordance with the Specifications and Drawings.

17. The Works to be completed by the Intended Completion Date

17.1 The Contractor may commence Execution of the Works on the Start Date and shall carry out the Works in accordance with the Program submitted by the Contractor, as updated with the approval of the Employer, and complete them by the Intended Completion Date.

18. Approval by the Employer

18.1 The Contractor shall submit Specifications and Drawings showing the proposed Permanent and Temporary Works to the Employer, who is to approve them if they comply with the Specifications and Drawings.

18.2 The Contractor shall be responsible for the Design of Permanent and Temporary Works.

18.3 The Employer's approval shall not alter the Contractor's Responsibility for Design of the Permanent and Temporary Works.

18.4 The Contractor shall obtain Approval of Third Parties for the Design of the Permanent and Temporary Works where required.

18.5 All Drawings prepared by the Contractor for the Execution of the Permanent or Temporary Works, are subject to prior Approval by the Employer before their use.

19. Safety

19.1 The Contractor shall be Responsible for the Safety of all Activities on the Site.

20. Discoveries

20.1 Anything of Historical or other Interest or of Significant Value unexpectedly Discovered on the Site is the Property of the Employer. The Contractor is to notify the Employer of such Discoveries and carry out the Employer's Instructions for dealing with them.

21. Possession of the Site

Refer Clause 17 of Special Conditions of Contract.

22. Access to the Site

22.1 The Contractor shall allow the Employer and any Person authorized by the Employer Access to the Site, to any Place where Work in connection with the Contract is being carried out or is intended to be carried out and to any Place where Materials or Plant are being manufactured / fabricated / assembled for the Works.

23. Instructions

23.1 The Contractor shall carry out all Instructions of the Employer which comply with the Applicable Laws where the Site is located.

24. Procedure for Resolution of Disputes

24.1 If the Contractor is not satisfied with the Decision taken by the Employer, the Dispute shall be referred by either Party to Arbitration within 30 days of the notification of the Employer's Decision.

24.2 If neither Party refers the Dispute to Arbitration within the above 30 days, the Employer's Decision will be final and binding.

24.3 The Arbitration shall be conducted in accordance with the Arbitration Procedure stated in the Special Conditions of Contract.

B. Time Control

25. Program

25.1 Within the Time stated in the Contract Data, the Contractor shall submit to the Employer for Approval a Detailed Program showing the General Methods, Arrangements, Order and Timing for all the Activities in the Works.

25.2 The Employer's Approval of the Program shall not alter the Contractor's Obligations. The Contractor may revise the Program and submit it to the Employer again at any time. A revised Program is to show the Effect of Compensation Events.

26. Extension of the Intended Completion Date

26.1 The Employer shall extend the Intended Completion Date if a Compensation Event occurs, which makes it impossible for Completion to be achieved by the Intended Completion Date.

26.2 The Employer shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Employer for a Decision upon the Effect of a Compensation Event and submitting Full Supporting Information.

27. Delays ordered by the Employer

27.1 The Employer may instruct the Contractor to delay the Start or Progress of any Activity within the Works.

28. Management Meetings

28.1 The Employer may require the Contractor to attend a Management Meeting. The Business of a Management Meeting shall be to review the Progress Achieved and the Plans for Remaining Work.

28.2 The Responsibility of the Parties for Actions to be taken is to be decided by the Employer either at the Management Meeting or after the Management Meeting and stated in writing to be distributed to all who attended the Meeting.

C. Quality Control

29. Identifying Defects

29.1 The Employer shall check the Contractor's Work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's Responsibilities. The Employer may instruct the Contractor to search for a Defect and to uncover and test any Work that the Employer considers may have a Defect.

30. Tests

30.1 If the Employer instructs the Contractor to carry out a Test not Specified in the Specification to check whether any Work has a Defect and the Test shows that it does, the Contractor shall pay for the Test and any Samples. If there is no Defect the Test shall be a Compensation Event.

31. Correction of Defects

31.1 The Employer shall give Notice to the Contractor of any Defects before the End of the Defects Liability Period, which begins at Completion and is defined in the Contract Data. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

31.2 Every time Notice of a Defect is given, the Contractor shall correct the Notified Defect within the Length of Time

specified by the Employer's Notice.

32. Uncorrected Defects

32.1 If the Contractor has not corrected a Defect within the Time Specified in the Employer's Notice, the Employer will assess the Cost of having the Defect corrected, and the Contractor will pay this Amount.

D. Cost Control

33. Financial Bid

33.1 The Financial Bid shall contain Items for the Construction, Installation, Testing and Commissioning Work to be done by the Contractor.

33.2 Deleted.

34. Variations

34.1 The Tenderer shall submit his Offer, which shall comply fully with the Basic Requirements of the Tender Documents as indicated in Drawings, Specifications, Terms and Conditions of the Tender.

34.2 All Tenderers are cautioned that no Conditional Offers, Variations or Deviations by the Tenderers in respect of any Items included in the Tender shall be entertained or considered. Furthermore, any Variations from Contract Conditions, Particular Specifications or other Requirements stipulated in the Tender Documents other than those specially clarified / amended shall be liable to be rejected as Non Responsive.

35. Payment for Variations

Deleted.

36. Submission of Bills for Payment

Refer Clause 18 of Special Conditions of Contract.

37. Payments

37.1 Payments shall be adjusted for deductions for Advance Payments, other than Recoveries in terms of the Contract and Taxes at source as applicable under the Law. The Employer shall pay the Contractor within 60 days of Submission of the Bill. The Contractor shall be liable to pay Liquidated Damages for Shortfall in Progress. For Progress beyond the Agreed Programme, Payment is subject to Availability of the Grants.

37.2 Items of the Works for which no Rate or Price has been entered in, will not be paid for by the Employer and shall be deemed covered by other Rates and Prices in the Contract.

38. Compensation Events

Refer Clause 19 of Special Conditions of Contract.

39. Tax

39.1 The Rates quoted by the Contractor shall be deemed to be inclusive of GST,all Taxes, Duties and Levies including Sales Tax, Municipal Taxes, Local Taxes, Octroi, ESI, all Royalties, Patent Rights, other Incidental Charges, etc. that the Contractor will have to pay for the Performance of this Contract. The Employer will perform such Duties in regard to the Deduction of such Taxes at Source as per Applicable Law. The Rate shall also include the Cost of all Labours, Materials, Plant, Machinery, Equipment's, Carriage and other Inputs involved in the Execution and Completion of the Work. **GST of 18% or as applicable at the time of payment shall NOT be paid separately as per the Govt Letter No. PWD 65 RDF 2017, dated 11-10-2018 as the quoted rates includes GST.**

40. Price Adjustment

Deleted.

41. Liquidated Damages

41.1 The Contractor shall pay Liquidated Damages to the Employer at the Rate per day stated in the Contract Data for each day that the Completion Date is later than the Intended Completion Date for the whole of the Works as stated in the Contract Data. The Total Amount of Liquidated Damages shall not exceed the Amount defined in the Contract Data. The Employer may deduct Liquidated Damages from Payments due to the Contractor. Payment of Liquidated Damages does not affect the Contractor's Liabilities.

41.2 If the Intended Completion Date is extended after Liquidated Damages have been paid, the Employer shall correct any Overpayment of Liquidated Damages by the Contractor by adjusting the Next Payment of Bill.

42. Advance Payments

Refer Clause No. 59 of Special Conditions of Contract.

43. Securities

43.1 The Security Deposit (including Additional Security for Unbalanced Tenders) shall be provided to the Employer no later than the Date Specified in the Letter of Acceptance and shall be issued in an Amount and Form acceptable to the Employer. The Security Deposit shall be valid until a date 30 days from the Date of Expiry of Defects Liability Period of 24 months plus Claim Period of 6 months and the Additional Security for Unbalanced Tenders shall be valid until a date 30 days from the Date of Issue of the Certificate of Completion.

44. Cost of Repairs

44.1 Loss or Damage to the Works or Materials to be incorporated in the Works between the Start Date and the End of the Defects Correction Periods shall be remedied by the Contractor at the Contractor's Cost if the Loss or Damage arises from the Contractor's Acts or Omissions.

E. Finishing the Contract

45. Completion

45.1 The Contractor shall request the Employer to issue a Certificate of Completion of the Works and the Employer will do so upon deciding that the Work is completed.

46. Taking over

46.1 The Employer shall take over the Site and the Works within seven days of issuing a Certificate of Completion.

47. Final Account

47.1 The Contractor shall supply to the Employer a Detailed Account of the Total Amount that the Contractor considers Payable under the Contract before the End of the Defects Liability Period. The Employer shall issue a Defect Liability Certificate and certify any Final Payment that is due to the Contractor within 90 days of receiving the Contractor's Account if it is Correct and Complete. If it is not, the Employer shall issue within 90 days a Schedule that states the Scope of the Corrections or Additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Employer shall decide on the Amount Payable to the Contractor and make Payment within 60 days of receiving the Contractor’s Revised Account.

48. As Built Drawings

48.1 If “As Built” Drawings are required, the Contractor shall supply them by the Dates stated in the Contract Data.

48.2 If the Contractor does not supply the Drawings by the Dates stated in the Contract Data, or they do not receive the Employer’s Approval, the Employer shall withhold the Amount stated in the Contract Data from Payments due to the Contractor.

49. Termination

49.1 The Employer may terminate the Contract if the other Party causes a Fundamental Breach of the Contract.

49.2 Fundamental Breaches of Contract include, but shall not be limited to the following.

a. The Contractor stops work for 45 days when No Stoppage of Work is shown on the Current Program and the Stoppage has not been authorized by the Employer.

b. The Contractor becomes Bankrupt or goes into Liquidation other than for a Reconstruction or Amalgamation.

c. The Employer gives Notice that Failure to correct a Particular Defect is a Fundamental Breach of Contract and the Contractor fails to correct it within a Reasonable Period of Time determined by the Employer.

d. The Contractor does not maintain a Security which is required.

e. The Contractor has delayed the Completion of Works by the Number of Days for which the Maximum Amount of Liquidated Damages can be paid as defined in the Contract data; and

f. If the Contractor, in the judgment of the Employer has engaged in Corrupt or Fraudulent Practices in competing for or in Executing the Contract.

For the purpose of this paragraph "**Corrupt Practice**" means the Offering, Giving, Receiving or Soliciting of anything of Value to influence the Action of a Public Official in the Procurement Process or in Contract Execution. "**Fraudulent Practice**" means a Misrepresentation of Facts in order to influence a Procurement Process or the Execution of a Contract to the Detriment of the Borrower and includes Collusive Practice among Tenderers (prior to or after Tender Submission) designed to establish Tender Prices at Artificial Non Competitive Levels and to deprive the Borrower of the Benefits of Free and Open Competition.

49.3 When either Party to the Contract gives Notice of a Breach of Contract to the Employer for a Cause other than those Listed under Sub Clause 49.2 above, the Employer shall decide whether the Breach is Fundamental or not.

49.4 Notwithstanding the above, the Employer may terminate the Contract for Convenience.

49.5 If the Contract is terminated, the Contractor shall stop work immediately, make the Site Safe and Secure and leave the Site as soon as reasonably possible.

50. Payment upon Termination

50.1 If the Contract is terminated because of a Fundamental Breach of Contract by the Contractor, the Employer shall prepare Bill for the Value of the Work done Less Advance Payments received upto the Date of the Bill, Less other Recoveries Due in Terms of the Contract, Less Taxes due to be deducted at Source as per Applicable Law and Less the Percentage to apply to the Work not completed as indicated in the Contract Data. Additional Liquidated Damages shall not apply. If the Total Amount due to the Employer exceeds any Payment due to the Contractor, the Difference shall be a Debt payable to the Employer.

50.2 If the Contract is terminated at the Employer's Convenience or because of a Fundamental Breach of Contract by the Employer, the Employer shall prepare Bill for the Value of the Work done, the Reasonable Cost of Removal of Equipment, Repatriation of the Contractor's Personnel employed solely on the Works and the Contractor's Costs of protecting and securing the Works and Less Advance Payments received upto the Date of the Certificate, Less other Recoveries due in Terms of the Contract and Less Taxes due to be deducted at Source as per Applicable Law and make Payment accordingly.

51. Property

51.1 All Materials on the Site, Plant, Equipment, Temporary Works and Works are deemed to be the Property of the Employer, if the Contract is terminated because of a Contractor's Default.

52. Release from Performance

52.1 If the Contract is frustrated by any Event entirely Outside the Control of the Employer or the Contractor, the Employer shall certify that the Contract has been frustrated. The Contractor shall make the Site Safe and stop work as quickly as possible after receiving this Certificate and shall be paid for all Work carried out before receiving it and for any work carried out afterwards to which Commitment was made

F. Special Conditions of Contract

The following Special Conditions of Contract shall be read in conjunction with the General Conditions of Contract and Instructions to Tenderers as an Extension and not in Limitation of the Obligations of the Contract. In case of Discrepancy between these Special Conditions of Contract and the General Conditions of Contract, the decision of the Employer shall be final and binding on the contractor.

1. The Eligible Tenderer shall submit his Tender for the Work on Turn Key Lump Sum Basis based on his own Design. In this connection, **Section 6** on the "Scope of Work" may be referred.

2. Work shall not be sublet.

3. The Contractor is not to vary or deviate from the Drawings, Specifications, Stipulation, Conditions of Contract or Instructions to execute any work of any kind whatsoever unless so authorized by the Employer in writing.

4. **Setting out**
The Contractor is to set out the whole of the Work in conjunction with an Officer to be deputed by the Employer and during the Progress of the Works to amend on the requisition of the Employer any errors, which may arise therein and provide all the necessary Labour, Materials and Equipments for doing so. The Contractor is to provide all Tools, Plant, Machinery, Labour, and Materials, which may be necessary and required for the Work. All Materials and Workmanship shall conform to the Relevant Specifications mentioned in the Tender Documents.

5. **Labour**
The Contractor shall make his own Arrangements for the Engagement of all Staff and Labour, Local or Other, and for their Payment, Housing, Feeding and Transport.

The Contractor shall, if required by the Employer, deliver to the Employer a Return in Detail, in such Form and at such Intervals as the Employer may prescribe, showing the Staff and the Numbers of the Several Classes of Labour from time to time employed by the Contractor on the Site and such other Information as the Employer may require.

6. **Compliance with Labour Regulations**
During Continuance of the Contract, the Contractor shall abide at all times by all existing Labour Enactments and Rules made there under, Regulations, Notifications and Bye Laws of the State or Central Government or Local Authority and any other Labour Law (including Rules), Regulations, Bye Laws that may be passed or Notification that may be issued under any Labour Law in future either by the State or the Central Government or the Local Authority. The Contractor shall keep the Employer Indemnified in case any action is taken against the Employer by the Competent Authority on Account of Contravention of any of the Provisions of any Act or Rules made there under, Regulations or Notifications including Amendments. If the Employer is caused to pay or reimburse, such Amounts as may be necessary to cause or observe, or for Non Observance of the Provisions Stipulated in the Notifications / Bye Laws / Acts / Rules / Regulations including Amendments, if any, on the part of the Contractor, Employer shall have the Right to deduct any Money due to the Contractor including his Amount of Security Deposit. The Employer shall also have Right to recover from the Contractor any Sum required or estimated to be required for making Good the Loss or Damage suffered by the Employer. The Employees of the Contractor in no case shall be treated as the Employees of the Employer at any point of time.

7. **Protection of Environment**
The Contractor shall take all Reasonable Steps to protect the Environment on and off the Site and to avoid Damage or Nuisance to Persons or to Property of the Public or others resulting from Pollution, Noise or other Causes arising as a Consequence of his Methods of Operation. During Continuance of the Contract, the Contractor shall abide at all times by all Existing Enactments on Environmental Protection and Rules made there under, Regulations, Notifications and Bye Laws of the State or Central Government, or Local Authorities and any other Law, Bye Law, Regulations that may be passed or Notification that may be issued in this respect in future by the State or Central Government or the Local Authority.

8. **Taxes and Duties**

The Lump Sum (L.S.) Amount for which the Tender is approved shall be inclusive of GST , all Expenses for the proper and entire Completion of the Work and shall be inclusive of all Taxes, Duties and Levies including Sales Tax, Municipal Taxes, Local Taxes, Octroi, all Royalties, Patent Rights, other Incidental Charges, etc. The Tenderer may consider Taxes, Duties, Royalties, etc. for the Purpose of Tendering prevailing one month earlier to the Date of Submission of the Tender. Subsequent Changes affected either by Government of Karnataka or Government of India, the Employer may consider Reimbursement of such Increase in the Taxes, Duties, Royalties, etc. upon proper Certification from Appropriate Tax Authorities. Any Reduction in Taxes, Levies, Royalties, etc. either by Government of Karnataka or Government of India, the Tenderer shall reimburse difference in such reduction to the Employer.

9. **Site Visit**

The Tenderer shall, prior to submitting the Tender for the work, examine the Drawings, Conditions of Contract and Specifications of Work. He shall visit the Site and ascertain and satisfy himself regarding Actual Climate and Physical Conditions of the Site, Nature, Extent and Practicability of Work, Means of Communication and Access to Site, Availability of Materials, the Extent of Leads and Lifts involved in the Work over the entire Duration of the Contract including Local Conditions, Probable Site for Labour Camps, Stores, Godowns, Casting Yard, Traffic Diversion, etc. The Tenderer's Offer shall take into Consideration all such Factors. The tenderer must obtain clarification on the scope of work referred to in the tender and the availability of railway and defense land with the concerned engineers, and obtain a certification for visiting the site and understanding the nature of the work and same should be uploaded in the e-procurement. The Tenderer shall obtain all necessary Information and other Circumstances, which may affect or influence his Tender. No Extra Charges consequent of any Misunderstanding or otherwise shall be allowed. The expression **'Site'** as stated above shall include the Construction Site of the Elevated Rotary /RoB and its approaches including all Components described in the Scope of Work.

10. **Arbitration (Clause 24)**

10.1 The Procedure for Arbitration shall be as follows.

a. In case of Dispute or Difference arising between the Employer and the Contractor relating to any Matter arising out of or connected with this Agreement it shall be settled in accordance with the Arbitration and Conciliation Act 1996. The Disputes or Differences shall be referred to a Sole Arbitrator. The Sole Arbitrator shall be appointed by Agreement between the Parties; failing such Agreement, by the Appointing Authority (any one of the Organizations as per list enclosed in **Annexure A**).

c. Arbitration Proceedings shall be held at Khanija Bhavan Bangalore, Karnataka, India.

c. The Cost and Expenses of Arbitration Proceedings will be paid as determined by the Arbitrator. However, the Expenses incurred by each Party in connection with the Preparation, Presentation, etc. shall be borne by each Party itself.

d. Performance under the Contract shall continue during the Arbitration Proceedings and Payments due to the Contractor by the Employer shall not be withheld, unless they are the Subject Matter of the Arbitration Proceedings.

11. Type of the Foundation shall be of suitable type (Pile Foundation / Open Foundation). However, there may be Instances where Pile Foundation is not Feasible (e.g. due to Presence of Rock at Shallow Depth or, Presence of a Utility), in which case he may be asked to redesign that Foundation as an Open Foundation.
In case of Failure of any Pile in the Routine Load Test, the Additional Cost on account of Remedial Measures including the Consultant's Fee for suggesting Remedial Measures shall be borne by the Contractor and no claim shall be entertained on this account.

12. The Tender Documents loaded in the kppp Portal, Tender Terms arrived at during Process of Clarifications

together with the Letter of Acceptance thereof, shall constitute a Binding Contract between the Successful Tenderer and the Employer and shall form the Foundation of the Rights and Obligation of both the Parties.

13. The Several Documents forming the Contract are to be taken as mutually explanatory of one another, Detailed Drawings being followed in preference to Small Scale Drawings and Figured Dimensions in preference to the Measured Ones. Special Conditions shall be followed in preference to General Conditions / Clauses of the Contract. Particular Specifications shall be followed in preference to General Specifications applicable to the Contract.

14. In case of Discrepancy / Inconsistency between the Description in the Scope of Works, Specifications, Nomenclature of Items and / or the Drawings, Conditions of Contract, Pre-Qualification Document and if there are Varying or Conflicting Provisions made in any Document forming Part of the Contract, the Employer shall be the Deciding Authority with regard to the Intention / Interpretation of the Document and his Decision shall be final and binding on the Contractor without any reservations.

15. The Right to carry out the Work either in Conformity with or in a Manner entirely different from the Terms of this Tender Document that may be considered most suitable before or subsequent to the Receipt of Tenders due to Exigencies of Work is reserved with the Employer.

16. Any Error in Description or any Omissions there from, shall not vitiate the Contract or release the Contractor from the Execution of the whole or any part of the Works comprised therein according to Drawings and Specifications or from any of his Obligations under the Contract.

17. **Possession of the Site (Clause 21)**
The Employer shall give the possession of the Site to the Contractor based on the mutually agreed Construction Schedule between the Employer and the Contractor. If possession of a Part is not given as per the mutually agreed schedule then the Employer will assess the Probable Delay that may arise due to non-availability of that particular part of Site to the Contractor.

18. **Submission of Bills for Payment (Clause 36)**

18.1 The Intermediate Billing Schedule shall be decided and mutually agreed upon by the successful Tenderer and the Employer on the basis of the Priced Bill of Quantities to be submitted by the successful Tenderer and shall be in accordance with **Annexure B** within Reasonable Alteration. Intermediate Payments shall be made on the Basis of Work assessed by the Employer which will be made on the basis of Quantum of total Work involved as per Intermediate Billing Schedule and Quantum of Work actually executed at a particular Point of Time (within that stage) for such items. The Decision of the Employer shall be final and binding for this Purpose.

18.2 The Contractor shall submit to the Employer Running Bills based on the Value of the Work completed as per the Percentage of Breakup of Lump Sum Cost less the Cumulative Amount Paid previously amounting not less than as shown in the payment schedule in Annexure B.

18.3 The Employer shall check the Contractor's Bill and determine the Value of the Work executed which shall comprise of Value of the Bill of Quantities based on the Percentage of Breakup of Lump Sum Cost Completed.

18.4 The Employer may exclude any Item paid in a Previous Bill or reduce the Proportion of any Item previously Paid in the Light of Later Information.

18.5 It shall be accepted as a Condition of the Contract that the Payment of the Final Bill of the Contractor, less the Withheld Amount and his Acceptance thereof shall constitute a Full and Absolute Release of the Employer from all further Claims by the Contractor under the Contract.

18.6 All Bills shall be prepared by the Contractor for submission, in the Prescribed Format or Typed Forms viz. Form 33A and 33B of PWD, which have to be procured by the Contractor and got approved by the Employer before

presenting the same.

19. **Compensation Events (Clause 38)**

19.1 The following are the Compensation Events for Time Extension only unless they are caused by the Contractor. In any case, these Compensation Events shall not entitle the Contractor to claim financially whatsoever.

a. The Employer does not give Access to a Part of the Site as per the mutually agreed Construction Schedule between the Employer and the Contractor.

b. The Employer orders a Delay or does not approve Drawings, Specifications or Instructions Required for Execution of Works on time.

d. The Employer instructs the Contractor to uncover or to carry out Additional Tests upon work which is then found to have no Defects.

c. The Employer gives an Instruction for dealing with an Unforeseen Condition, caused by the Employer, or Additional Work required for Safety or other Reasons.

e. The Effect on the Contractor of any of the Employer's Risks.

d. The Employer unreasonably delays issuing a Certificate of Completion / Scheduled Payment.

g. Other Compensation Events listed in the Contract Data or mentioned in the Contract.

19.2 If a Compensation Event would prevent the Work being completed before the Intended Completion Date, the Intended Completion Date may be extended. The Employer shall decide whether and by how much the Intended Completion Date shall be extended.

19.3 The Contractor shall not be entitled to Compensation to the Extent that the Employer's Interests are adversely affected by the Contractor not having given Early Warning or not having cooperated with the Employer.

20. Time is the Essence of the Contract and it shall be clearly understood that the Contractor is bound to complete the Work in every respect within the Intended Completion Period as stated in the Contract Data.

21. Within ten days from the Date of Signing the Agreement, the Contractor shall submit to the Employer for his Approval, a Time and Progress Chart in direct relation to the Intended Completion Period stated in the Contract Data for Completion of the Items or Groups of Items of Work and for the Contract as a whole. It shall indicate the Procedure and Method in which the Work is proposed to be carried out, the Forecast of the Dates of Commencement and Completion of Various Grades or Sections and the Arrangements regarding Constructional Plant and Temporary Works, which the Contractor intends to make. The Programme of Work may be amended as and when necessary by agreement between the Employer and the Contractor within the Limitations of Time imposed by the Contract Documents.

a. The Total Work to be executed shall be divided into seven to ten Milestones on mutually agreed Schedule between the Employer and the Contractor. These Milestones shall be based on Financial Progress in concurrence with respective Physical Progress. Progress of Work will be reviewed monthly / at the end of the each Milestone. In case the Progress achieved falls short by more than 25% of the Cumulative Programme, the Reasons for such Shortfall shall be examined and a Record made thereof apportioning the Responsibilities for the Delay between the Contractor and the Employer. This Record shall be signed in full and dated by both the Employer and the Contractor.

b. In respect of the Shortfall in Progress (reviewed monthly / at the end of the each Milestone), assessed as due to the Delay on the Part of the Contractor, the Contractor shall be Liable to pay as Penalty an Amount equal to **1%** of the Estimated Cost of the Balance Work assessed according to the Programme, for every day that

the due Quantity of the Work remains incomplete provided always that the Total Amount of Penalty to be paid under the Provisions of this Clause shall not exceed **10%** of the Lump Sum Contract Value as quoted by the Contractor. In case the Contractor picks up the Progress and completes all Works as per Tender within the Intended Completion Period, the Entire Amount so recovered above will be returned back to the Contractor without any Interest. The Time of Completion is to be certified by the Committee formed for this Purpose by the Employer.

22. On the basis of Project Scheduling, the Contractors shall also supply Monthly Bar Chart for Completion of each Item of Work and other necessary Information for monitoring the Progress of the Work. The Contractor shall also supply suitably Updated Monthly Bar Charts, etc. incorporating inter alia the Decision taken during Site Inspections / Review Meetings.

23. The Approval of the above Programme by the Employer shall not absolve or relieve the Contractor of any of his Responsibilities to complete the whole of the Works by the Intended Completion period or Extended Completion Period, if any.

24. **Progress of Work**

The Contractor shall give the Employer on the 4th Day of each Month a Progress Report of the Work done during the Previous Month.

The Progress of Work will be reviewed periodically by the Employer with the Contractor and Shortfalls, if any sorted out, the Contractor shall thereupon take such Action as may be necessary to bring back his Work to Schedule without any Additional Cost to the Employer by employing Overtime Operations, increasing the Number of Shifts, Capacity of the Equipment or otherwise as directed by the Employer and nothing shall be paid extra.

25. **Drawings to be kept at Site**

The Required Sets of the Drawings as approved by the Employer shall be kept by the Contractor at the Site and the same shall at all reasonable time be available for Inspection and Use by the Employer and his approved Representative and any other person authorized by the Employer in writing.

26. **Inspection of Works**

In addition to the Provisions of Relevant Clauses of the Contract, the Work shall also be open to Inspection by the Employer and his approved Representative. The Contractor shall at all times during the Usual Working Hours and at all times at which Reasonable Notices of the Intention of the Employer or his approved Representative as stated above to visit the Works shall have been given to the Contractor, either himself be present to receive the Orders and Instructions or have a responsible Site Engineer duly accredited in writing, to be present for that Purpose.

27. **Foreign Exchange**

It shall be clearly understood that no Foreign Exchange shall be made available for the Purpose of Equipment, Plants, Machinery or Materials of any kind or any other Items / Purposes required to be carried out in Execution of the Work. It shall be clearly understood that no Foreign Exchange required for importing Equipments, Materials for Tools, Plants and Machinery, etc. that may be required in carrying out the Work, even from the Rupee Payment Country will be made available.

28. **Night Work**

For Completing the Work well within the Intended Completion Period, the Contractor might be required to work in two or more Shifts (including Night Work) and no Claim whatsoever shall be entertained on this account, not withstanding, the Fact that the Contractor will have to pay to the Labours and other Staff engaged directly or indirectly on the Work according to the Provisions of the Labour Regulations and the Agreement entered into and for Extra Amounts towards any other Reason. None of the Permanent Works shall be carried out during Night or on Authorized Public Holidays without the permission in writing of the Employer except when Work is unavoidable or absolutely necessary for the Safety of Life, Property or Work in which case the Contractor shall

immediately advise the Employer accordingly, provided that the Provisions of this Condition shall not be Applicable in the case of any Work which is customary to carry out by Rotation or in Double Shift.

29. **Existing Services**
Existing Drains, Pipes, Cables, Overhead Wires, Sewer Lines, Water Lines and similar Services encountered in the Course of the Execution of the Work shall be protected / maintained against the Damage by the Contractor. The Contractor shall not store Materials or otherwise occupy any part of the Site in a manner likely to hinder the Operation of such Services. In case Temporary Shifting of such Services is required to facilitate the Work, the Contractor at no Extra Cost shall do the same.

30. No Work shall be covered or put out of View without the Approval of the Employer or his approved Representative and the Contractor shall afford Full Opportunity for Examination of such Services before these are permanently installed or extended thereof as per Site Requirement.

31. No Accommodation is available at the Site of Work for Office, Residence, Labour, Store, etc. and the Contractor has to make his own Arrangement and no Claim whatsoever on this account shall be entertained.

32. The Contractor shall make his own arrangement for the Disposal of the Spoils from the Works to such Place where the same shall not cause Nuisance and shall be acceptable to the Authorities concerned.

33. The Execution of any Items of Work where any Incidental Work is actually required but not specifically stated in the Tender Document, it is to be understood that the Amount quoted by the Contractor shall cover such Charges also and nothing extra on account of such Incidental Charges, if any, shall be paid.

34. The Contractor shall make his own arrangement at his own Cost for the Provision of Telephone Facilities at the Site of Works or at any other place.

35. The Electric and Water Connections to be obtained for use of the Work under the Contract are subject to the following Conditions.
    a. The Contractor shall make his own arrangement for Electricity and Water Supply. However, the Employer will assist the Contractor to get Power from the concerned Department at the Contractor's Cost.

    b. The Employer shall in no way be Responsible for any Delay in getting the Electric Connection and Water and no Claim on this account whatsoever, shall be entertained. It shall be clearly understood that the Contractor has to make his own Arrangement for Generators for use before the Electric Connection is made available and also to be used as a Standby Arrangement in case of Power Failure, etc. or in the case of Disconnection of Electric Supply by the concerned Department for any reason.

36. No Payment will be made to the Contractor for Damage caused by Unprecedented Rains, or other Natural Calamities or Accidents or Acts of God, during the Execution of the Works and no such Claim on this account will be entertained in this regard the Govt/employer decision is the final.

37. The Contractor is required to submit Rates of all Items he has used to derive the Tendered Price inclusive of Cost of all Labour, Materials, Plant, Machinery, Equipments, Carriage and other Inputs, Taxes, Royalties, etc.

38. The Contractor shall maintain in Good Condition all Work till the Completion of entire Work allotted to him. From the Commencement of the Work to the Completion of the same, the Work is to be under the Contractor's Charge. The Contractor is to be held Responsible for and to make good all Injuries, Damages and Repairs, rendered necessary by Fire, Rain, Traffic, Floods or other Causes. The Employer shall not be held Responsible for any Claims for Injuries to Personal Workmen or for Structural Damage to Property happening from any Neglect, Default, Want of Proper Care or Misconduct on the Part of the Contractor or of any other of his authorized Representatives in his Employment during the Execution of the Work. The Compensation, if any, shall be paid directly to the Department / Authority / Persons concerned by the Contractor at his own Cost.

39. The Contractor will take all Necessary Measures for the Safety of Traffic and Workers during Construction and provide, erect and maintain such Barricades, including Signs, Markings, Flags, Lights and Skilled Flagmen, as necessary, all around the Excavation / Construction Area and at such Intermediate Points, as directed by the Employer including the Proper Identification of the Construction Areas. He shall be Responsible for all Damages and Accidents on account of Construction and other Relevant Activities. Nothing shall be paid extra on account of above.

The Temporary Warning Signs / Lamps shall be installed at all Barricades during the Hours of Darkness and kept lit there at all times during these hours and nothing shall be paid extra.

Barricading and Safety Requirements are very Important Aspects at this Portion of the Road. The above Provisions shall be followed strictly and at no time the Construction / Excavation Areas are to be left Unbarricaded or without Red Lamps during the Hours of Darkness. Failure to comply with the Requirements mentioned in the Preceding Paragraphs shall be deemed to be a Breach of Contract on the Part of the Contractor for which the Contractor shall be Liable to action under Relevant Clauses / Conditions of the Agreement.

In addition to other Actions being taken for such Breach of Contract, the Contractor shall be liable to pay compensation @ Rs.1000/- per Sqm of Area left UN barricaded.

The Employer shall give Notice to the Contractor for such Barrication and the Contractor shall comply with the same within one day of such Notice failing which he shall be liable to pay the above Compensation and Actions for the said Breach of Contract. The Decision of the Employer in respect of the above shall be final and binding.

The Contractor shall use every Reasonable Means to prevent any of Roads, Bridges communicating with or on the Routes to the Site from being damaged by any Traffic of the Contractor or any of his Sub Contractors and in particular, shall select Routes and Vehicles to avoid such Unnecessary Damages.

40. All Arrangements for Traffic Diversion during Construction including Maintenance thereof (within the Battery Limits) shall be considered as Incidental to the Work and Contractor's Responsibility. The Contractor shall obtain Necessary Approval of the Diversion Plans from the concerned Authorities. The Contractor's Turn Key Lump Sum Quoted Rate shall also be inclusive of any Incidental Work required for providing Adequate Carriageway Width to Traffic as acceptable to the Authorities.

41. **Safety of Workers**

In respect of all Labour directly or indirectly employed in the Work for the Performance of the Contractor's Part of this Agreement, the Contractor shall at his own Expense arrange for the Safety Provisions as per Indian Standard Safety Codes (Latest Edition) shown below and shall at his own Expense provide all Facilities in connection there with. In case, the Contractor fails to make Arrangement and provide Necessary Facilities as aforesaid, he shall be liable to pay **Rs. 10000/-** per Day for each day of Delay from the Date of Notice issued to the Contractor in this regard and in addition the Employer shall be at liberty to make Arrangement and provide Facilities as aforesaid and recover the Cost incurred on that behalf from the Contractor, and no Claims whatsoever shall be entertained.

i.	IS: 3696 (Part I)	Safety Code for Scaffolds and Ladders
ii.	IS: 3696 (Part II)	Safety Code for Scaffolds and Ladders, Part II Ladders
iii.	IS: 3764	Safety Code for Excavation Work
iv.	IS 4081	Safety Code for Blasting and Drilling Operations
v.	IS: 4138	Safety Code for Working in Compressed Air
vi.	IS: 5121	Safety Code for Piling and other Deep Foundations
vii.	IS: 5916	Safety Code for Construction involving Use of Hot Bituminous Materials
viii.	IS: 7293	Safety Code for Working with Construction Machinery
ix.	IS: 7969	Safety Code for Storage and Handling of Building Materials
xi.	Any other Code and / or as per Directions of the Employer.	

42. The Employer shall have full powers to send Workmen and employ on the Premises to execute Fittings and other Work not included in the Contract. For whole Operations, the Contractor is to afford every Reasonable Facility during Ordinary Working Hours provided that such Operations shall be carried on in such a manner so that not to impede the Progress of the Work included in this Contract in the opinion of the Employer.

43. The Contractor shall conduct his Work so that not to interfere with or hinder the Progress or Completion of the Work being performed by other Contractors, Piece Workers or by the Employer and shall as far as possible arrange his Work and shall place and dispose the Operations of the other Contractors, Piece Workers, or of the Employer. The Contractor shall arrange his Work with that of the others in an Acceptable Manner and shall perform it in Proper Sequence to the complete Satisfaction of the Employer at the Contractor's own Cost.

44. The Contractor shall assume all Liabilities, Financial or otherwise in connection with his Contract and shall protect and save the Employer from any and all Damages and Claims that may arise because of the Presence and Operations of others working on or near the Site. The Contractor shall assume all Responsibilities for all Work not completed or accepted because of the Presence and Operations of other Contractors or Piece Workers or of the Employer.

45. At the time of Construction, the Contractor shall embed all Electrical / other Fixtures like Base Plates, Brackets, Conduits, etc. for Street Lighting, etc. as per the Directions of the Employer. Nothing Extra whatsoever will be payable on this account.

46. For execution of any Items of Work where Incidental Works such as Bailing out Water, Shoring, etc. are actually required but not specifically stated in the Tender, it is to be understood that the Lump Sum Amount quoted by the Contractor shall cover such Charges also and nothing Extra on account of such Incidental Charges, if any, shall be paid.

47. **No Waiving of Legal Rights and Powers**

The Employer shall not be precluded or stopped from taking any Measurements and Framing of Estimates or Detaining any Certificates made either before or after the Completion and Acceptance of the Work and Payment, from showing the True Amount and Character of the Works Performed and Materials furnished by the Contractor and from showing that any such Measurements, Estimates or Certificates Untrue or incorrectly made and that the Employer shall not be precluded or stopped from recovering from the Contractor and such Damages as it may be sustained by Reasons of his Failure to comply with the Terms and Conditions of the Contract. Neither the Acceptance by the Employer nor any Payment for Acceptance of the whole or any part of the Work nor any Extension of Time nor any Possession taken by the Employer shall operate as a Waiver of any Portion of the Contract or any Power herein reserved or of any Risk to Damage. A Waiver of any Breach of the Contract shall not be held to be a Waiver of any other or subsequent Breach.

48. The Contractor shall provide and bear all Expenses and Charges for Special or Temporary Service Roads required by him in Connections with Access to the Site at no Extra Charges and his Lump Sum Offer shall deem to include the same. He shall alter, adopt or maintain the same as required from time to time or as directed by the Employer. The Employer shall have Right of Way to this at all times and will not entitle the Contractor to claim Extra on this account.

49. The Tenderers shall also mention with their Tender Documents the Name of their Project Managers, Work Managers, and Graduate Engineers who shall be engaged in this Work. The Biodata of such Engineers / Managers are to be enclosed with the Tender Documents.

50. The Tenderers may specify the Number and Category of each type of Skilled Personnel to be deputed by the Contractors. It may clearly be stated that whether such Skilled Persons are under the Employment of the Tenderers or are still to be appointed by them. The Number of Skilled and Unskilled Persons to be employed shall be in agreement with the Programme of Work submitted by the Tenderers and discussed elsewhere in the Tender Documents.

51. in addition to the clause 3.3 a in The Tenderers shall further specify the additional provisions of Plant and Machinery to be deployed by them for the Work on the safer side and smooth functioning of project (Proof of documents having making arrangements either own / lease / hire of following equipments shall be submitted in the portal).

i. Source of Ready Mix Concrete (RMC) Suppliers and their rated Capacity in cum / hr.
ii. Loaders.
iii. Tippers with adequate Capacity to suit Site Conditions and Construction Schedule.
iv. Dumpers.
v. Trucks.
vi. Transit Mixers.
vii. Vibrators (Needle, Surface and Shutter).
viii. Compressors.
ix. Multistrand Pre Stressing Jacks.
x. Grouting Equipment and Accessories.
xi. Hydraulic Jacks (Capacity and Nos.).
xii. Concrete Pumps (expected total Capacity – 50 cum / hr. of 2 Nos.)
xiii. Hydraulic Rotary Rig of minimum 1000mm diameter.
xiv. Cranes (expected minimum 2 Nos. of 50T Capacity each).
xv. Excavators (expected total Capacity – 200 cum / hr., Capacity, Nos.).
xvi. Road Construction Machinery.
xvii. Generators.
xviii. Water Pumps – Number and their Capacity.
xix. Trailer Trucks and any other Equipment.

52. The Tenderers shall furnish a Cash Flow Chart on month – to – month basis for the entire Period of Execution of the Work. The Cash Flow Chart shall indicate specifically the Investments on Items such as Plant and Machinery, Shuttering and Staging, Materials mentioning Various Items like other Pre Stressing Materials, Sand, Grit and other Consumables. The Cash Flow shall indicate in Detail, the Inputs to be mobilized by the Contractor from his own Sources e.g. own Capital, Bank Loans, etc. and Resources to be supplemented by the Employer like Mobilization Advance and Interim Payments against the Work done by the Contractor.

The above mentioned Cash Flow shall have Direct Relation with the Programme of Work and it shall be in consonance thereto. Any Inconsistency between the Inputs / Outputs of this Cash Flow and Programme of the Work may lead to the Disqualification of the Tenderer on this account.

Similarly, after Award of the Contract also the Contractor shall submit Similar Cash Flow Programmes and update such Details at monthly intervals for monitoring of the Project by the Employer.

.

53. The Contractor is expected to have a Workshop Facility available at Site for Fabrication / Additions and

Alterations to the Shuttering, Pre Stressing Works and or other Allied Works. It may please be indicated that whether the Workshop Facilities shall be provided in house or is proposed to be subcontracted locally. In both the cases, the Tenderer is to give the Details and Number of Equipments to be installed in the Workshop for above mentioned Work.

54. The Employer shall deploy Third Party/Project Management Consultant (PMC) for Design Checking and Approval, Supervision, Quality Control, Progress Monitoring, etc. The Contractor shall abide by the Instructions / Suggestions given by the PMC for the successful completion of the Project.

55. **Interference with Traffic and Adjoining Properties**

a. All Operations necessary for the Execution and Completion of the Works and the Remedying of any Defects therein shall, so far as Compliance with the Requirements of the Contract Permits, shall be carried out so that not to interfere unnecessarily or improperly with the following.
   i. The Convenience of the public, or

   ii. The Access to, Use and Occupation of Public or Private Roads and Footpaths or of Properties whether in the Possession of the Employer or of any other person.

b. In case any Operation connected with the Traffic necessitates Diversion, Obstruction or Closure of any Road, Railway or any other Right of Way, the Approval of the Employer and the Concerned Authorities shall be obtained well in advance by the Contractor.

56. **Avoidance of Damage to Roads**

The Contractor shall use every Reasonable Means to prevent any of the Roads, Bridges communicating with or on the Routes to the Site from being damaged, injured by any Traffic of the Contractor or any of his Sub Contractors and in particular, shall select Routes, choose and use Vehicles and restrict and distribute Loads so that any such Extraordinary Traffic as will inevitably arise from the Moving of Materials, Plant, Contractor's Equipment or Temporary Works from and to the Site shall be limited, as far as reasonably possible, and so that no Unnecessary Damage or Injury may be occasioned to such Roads and Bridges.

57. **Transport of Contractor's Equipment or Temporary Works**

a. The Contractor shall be Responsible for and shall pay the Cost of Strengthening any Bridges or altering or improving any Road communicating with or on the Routes to the Site to facilitate the Movement of Contractor's Equipment or Temporary Works and the Contractor shall indemnify and keep indemnified the Employer against all Claims for Damage to any such Road or Bridge caused by such movement, including such Claims as may be made directly against the Employer, and shall negotiate and pay such Claims arising solely out of such Damage.

b. If it is found necessary for the Contractor to move one or more Loads of Heavy Constructional Plant and Equipment, Materials or Precast Units or Parts of Units of Work over Roads, Highways, Bridges on which such Oversized and Overweight Items are not normally allowed to be moved, the Contractor shall obtain Prior Permission from the Concerned Authorities. Payments for complying with the Requirements, if any, for Protection of or Strengthening of the Roads, Highways or Bridges shall be made by the Contractor and such expenses shall be deemed to be included in his Contract Price.

58. **Unpriced Bill of Quantities**

i. The Contractor shall furnish Unpriced Bill of Quantities along with the Technical Bid in order to ascertain the Scope of Work, to enable Technical Acceptability and to ensure Completion of Work within the Stipulated Time Schedule.

ii. The Contractor shall carry out all the Items required for the Construction of Construction of ROB at Baiyappanahalli at LC No:136A, Bangalore including construction of Elevated Rotary fly over at IOC junction and construction of road integrating Banaswadi main road and Old madras road to facilitate

connectivity to new M.Visvesvaraya terminal at Baiyappanahalli railway station and shall include all such Items in the Unpriced Bill of Quantities.

iii. The Unpriced Bill of Quantities will be considered only for the General Assessment of the Tender and it shall not be deemed to contain all the Items necessary for the Successful Completion of Construction of ROB at Baiyappanahalli at LC No:136A, Bangalore including construction of Elevated Rotary fly over at IOC junction and construction of road integrating Banaswadi main road and Old madras road to facilitate connectivity to new M.Visvesvaraya terminal at Baiyappanahalli railway station.

iv. During Execution, Items other than indicated in the Unpriced Bill of Quantities, but required for Construction of ROB at Baiyappanahalli, Bangalore including construction of Rotary fly over at IOC junction and construction of road integrating Banaswadi main road and Old madras road to facilitate connectivity to new M.Visvesvaraya terminal at Baiyappanahalli railway station, and Allied Works shall be executed by the Contractor and the Employer shall not be liable for any Additional Payment in this regard.

59. **Advance Payments (Clause 42)**

i. The Employer shall make Payment to the Contractor of the Amounts stated in the Contract Data by the Date stated in the Contract Data, against provision by the Contractor of an Unconditional Bank Guarantee in a form acceptable to the Employer issued by a Nationalized / Scheduled Bank in Amounts equal to the Advance Payment. The Guarantee shall remain Effective until the Advance Payment has been repaid, but the Amount of the Guarantee shall be progressively reduced by the Amounts repaid by the Contractor. The Advance payment Amount will be recovered by the Employer in five (5) equal Installments from the Running Account Bill of the Contractor. Interest will not be charged on the Advance Payment.

ii. The Contractor is to use the Advance Payment only to pay for Mobilization Expenses required specifically for execution of the Works. The Contractor shall demonstrate that Advance Payment has been used in this way by Supplying Copies of Invoices or other Documents to the Employer.

60. **Personal Protective Equipment**

The Contractor shall at all times keep and maintain an adequate supply of suitable Personal Protective Equipment, which shall be readily available for use at all times on the site and would include but not to be limited to the following Items.

- Safety Helmets.
- Hearing Protection.
- Respiratory Protection.
- Eye Protection.
- Protective Gloves.
- Safety Footwear.
- High Visibility Clothing conforming to BS EN 471 Class 3 Standards.

All Sites shall be designated as HARD HAT and SAFETY BOOTS SITES and as such an adequate supply of Safety Helmets and Safety Boots shall be kept available for use by all Staffs, Workers and Authorised Visitors to the Sites. The Contractor shall remove from the Site any worker who consistently refuses to wear the appropriate Personal Protective Equipment.

All Workmen at Site shall be provided with Safety Helmets and Yellow / Orange Jackets. Workmen required on Site during night hours shall be provided with Fluorescent Yellow Jackets with Reflective Lopes. Workers employed on

mixing Asphaltic Materials, Cement, Lime Mortars, Concrete, etc. shall be provided with Protective Footwear, Protective Goggles. Those engaged in handling any Material, which is injurious to the eyes, shall be provided with Protective Goggles. Those engaged in Welding Works shall be provided with Welder's Protective Eye Shield. Stone Breakers shall be provided with Protective Goggles and Protective Clothing and seated at sufficiently safe intervals.

61. **First Aid**

The Contractor shall maintain, at every Work Place, in a readily accessible place First Aid Appliances including an adequate supply of Sterilised Dressings, Bandages, Sterilised Cotton Wool, Eye Irritation Sterile Solution, Disposable Gloves, Ointments for Burns / Cuts, Pressure Dressings, Paper Towels, General Purpose Medicines, etc. as prescribed in the Factory Rules of the State in which the Work is being carried out. The Appliances shall be kept in good order and in large work places. They shall be placed under the charge of the Safety Officer deputed by the Contractor for this Work and the Safety Officer shall be readily available during Working Hours. In each Site Office and Location one Person, suitably trained in First Aid, shall be available at all Working Hours for the purpose of attending to emergencies.

Outbreak of infectious disease: The contractor shall remove from his camp such labour and their families as refuse protective inoculation and vaccination when called upon to do so by the Engineer or the Engineer's representative on the advice of the BBMP, Should cholera, plague, Covid-19 or other infectious disease break out, the contractor shall burn the huts, beddings, clothes and other belongings of or used by the infected parties and promptly erect new huts on healthy sites as required by the engineer , failing which within the time specified in the Engineer's requisition, the work may be done by the BBMP and the cost thereof recovered from the contractor.

62. **Fire Precautions**

The Contractor shall be responsible for supplying and maintaining adequate Fire Precaution Facilities on all the Work Sites. The following minimum Standards shall be adhered to.

- The Contractor shall ensure that specially trained personnel are available to deal with fires due to Electrical Causes, Gas Explosions, etc.
- A Good Standard of Housekeeping shall be maintained at all times on the Sites.
- No Accumulations of Rubbish shall be allowed to gather.
- Combustible Scrap and other Construction Debris shall be disposed off site on day – to – day basis. If Scrap is to be burnt on site, the burning site shall be specified and located at a distance no less than 50m from any Construction Work or any other Combustible Materials.
- Signage shall be erected at prominent positions showing the correct use of Portable First Aid Fire Extinguishers.
- Emergency Plans and Fire Evacuation Plans shall be prepared and issued. Mock Drills shall be held on a regular basis to ensure the Effectiveness of the Arrangements.

63. **Fire Fighting Equipment**

At various locations around the Site, clearly visible Fire Points shall be established for use in an Emergency and each Fire Point should have available as a minimum the following type of Equipment.

- Dry Powder Extinguisher.
- Water Type Extinguisher.
- Bucket of Sand.

Recharging of Fire Extinguishers and their Proper Maintenance should be ensured and as a minimum should meet Indian National Standards.

The Telephone Number of the Local Fire Brigade along with other Emergency Numbers (Hospital, Police Stations, Ambulance, etc.) shall be displayed near each telephone on Site. Supervisors and Workmen at the Site should be trained in the Use of Fire Fighting Equipment provided at the Site.

64. **Storage of Flammable Liquid**

All Flammable Liquids shall be kept in a Secure Fire Resistant Store protected from Electrical Sparks, Welding Sparks, Open Flames and Smoking.

Only such amounts of Flammable Liquids shall be issued as are required for immediate use.

Cans for carrying Flammable Liquids shall be leak proof and properly stoppered and clearly marked "Flammable Liquid".

Rags soaked in Paints, Kerosene and other Flammable Liquids shall be disposed of daily under supervision. Large quantities of such rags shall not be allowed to accumulate.

All Diesel Fuel Storage Tanks shall be bunded around in order to control any Spillage or Leakage that may occur.

"No Smoking" Signs shall be prominently displayed at all areas where Flammable Materials are stored.

65. **Release of Performance Security**

95% of Performance Security shall be released after satisfactory completion of Project Defect Liability Period of 24 Months and the balance 5% shall be released only after satisfactory completion of Maintenance Period of further 36 Months after Defect Liability Period.

Annexure A:

LIST OF ORGANIZATIONS WHO ARE CONSIDERED AS APPOINTING AUTHORITY FOR APPOINTMENT OF ARBITRATORS

Arbitration Centre, Khanija Bhavan, Bengaluru

Annexure-B Intermediate Payments- Schedules clause-18 of GC

Sl. No.	Particulars	Total %	Sub Distribution
1	**Studies/ Investigations/ Surveying, design**	**1.00%**	
	a. Studies Reports		0.25%
	b. Investigation Reports		0.25%
	c. Surveying Reports		0.25%
	d. Design & Drawings		0.25%
2	**Approval of General Alignment Drawings**	**1.00%**	
	a. Elevated Rotary Flyover with approaches		0.50%
	b. Road Over Bridge at L C No 136/A		0.50%
3	**Mobilisation including setting up office and establishing Bench Marks**	**1.50%**	
	a. Constn. Of Site office		0.21%
	b. Constn. Of labour camp		0.21%
	c. Constn. Of toilet facility to labour including basic amenities, water supply, sanitary etc.		0.21%
	d. Establishment of Benchmark and Transfer of GTS along with Report		0.21%
	e. Construction Equipments		0.21%
	f. Lightings at site and labour camp with Generator		0.21%
	g. Setting out/marking of Flyover/ROB with approaches		0.21%
4	**Foundation**	**25.00%**	
	Elevated Rotary Flyover with approaches Foundation upto Ground level		
	a) Open /Pile Foundation		15.00%
	b) ROB at LC NO.136A		10.00%
5	**Sub structure of Flyover including Pier/Piercap**	**23.00%**	
	a) Rotray with Approcaches		15.00%
	B) ROB at LC NO:136A		8.00%
6	**Super structure of Flyover**	**30.00%**	
	a) Elevated Rotary with approaches		20.00%
	b) ROB at LC NO:136A		10.00%
7	**Construction of Reinforced Earth Structures**	**4.50%**	
	a) Rotary Approaches		3.00%
	b) ROB at LC NO 136A		1.50%

8	**Wearing coarse**	**0.75%**	
	On Rotary Flyover and Approaches		0.60%
	On ROB at LC NO:136A		0.15%
9	**Construction of Service Road**	**7.00%**	
	At all approach sides including Banasavadi		
	a) Site Clearance/Dismantling		0.25%
	b) Earthwork		0.25%
	c) Drain/Culvert		1.00%
	d) Subbsase GSB/WMM		1.00%
	e) Finishing work		1.50%
	f) Base/Surface work		2.00%
	g)Road marking and Appartunanace		1.00%
10	**Defence related works as perscope**	**0.25%**	0.25%
11	**Electrical & Illumination**	**1.00%**	
	On Rotary Flyover and Approaches		0.50%
	On ROB at LC NO:136A		0.25%
	c. Service road Portion		0.25%
12	**Over all finishing on completion**	**2.00%**	
	a. Over all finishing Flyover/ROB portion, such as painting, lane marking, gantry etc.		1.00%
	b. Over all finishing Service Road portion, such as painting, lane marking, etc.		1.00%
13	**On Completion of work & 30 days after opening for Traffic**	**3.00%**	
	a) Rotary Flyover portion with Approaches		1.50%
	b) ROB at LC NO 136A with approaches		1.00%
	c) Service road at grade		0.50%
	Grand Total	**100.00%**	**100.00%**

SECTION 6: SCOPE OF WORK AND DESIGN CRITERIA

Table of Contents **Page No.**

1.0	Scope of Work		53
1.1	General		53
1.2	Site		54
1.3	Works to be carried out		54-57
2.0	Design Criteria		58
2.1	General and Approach to Work Site		58
2.2	Benchmarks and Setting out of Works		58
2.3	General Requirements		59
2.4	Specifications for Design and Codes to be followed		60
2.5	Order of Precedence in case of Conflict		61
2.6	Soil Investigation to be carried out by the Contractor		62
2.7	Restrictions on Type of Structures		62
2.8	Concept and Alignment plan of Elevated Rotary Flyover and ROB at LC No 136A		62
	2.8.1	Elevated Rotary Flyover	63-64
	2.8.2	Road Over Bridge	65-66
	2.8.3	Design Data	67
	2.8.4	Description of Work and Viaduct Provisions for Alternative Proposals	68
	2.8.5	Design Loads	69
	2.8.6	Durability	69
	2.8.7	Foundation	70-71
	2.8.8	Substructure	72
	2.8.9	Superstructure	73-74
	2.8.10	Bearings below Superstructure	75
	2.8.11	Expansion Joint	76
	2.8.12	Crash Barrier	76
	2.8.13	Drainage	76
	2.8.14	Wearing Coat	76
	2.8.15	Approach Slab	76
	2.8.16	Electrical Works	76
	2.8.17	Integrity Test	77
	2.8.18	Painting	77
2.9	Load Test		77
2.10	Slip Roads, other Surface Level Roads and Junction Improvements		78
2.12	Submission of Elevated Rotary/ROB design Reports for Railway approval		78
2.13	Safety precautions and measures to be observed during execution of Elevated		79

Rotary/ROB works in Railway and Adjoining areas

2.14 Resurfacing / Reconstruction of Surface Level Roads and Providing New Drainage System 80

2.15 Traffic Signs, Markings and other Road Appurtenances 80

2.16 Drainage System 80

2.17 Corridor Improvement Works 80

2.17.1 Carriageway Improvement Works 81

2.17.2 Paved Pedestrian Crossing 82

2.17.3 Pipe Duct 82

2.17.4 Road Side Drain 82

2.17.4.1 Construction of new RCC Drain covered with new RC Precast Slab 83

2.17.5 Kerb 83

2.17.6 Footpath 83

2.17.7 Illumination 84

2.17.8 Traffic Signage and Marking 84

2.17.9 Bus Shelter 84

2.17.10 Project Cost estimate 84

3.0 Documentation, Instrumentation, etc. 84

4.0 Programme of Submission and Approval of Designs and Drawings 85

5.0 Construction Schedule 86

6.0 Site Office 86

7.0 Field Laboratory 87

7.1 General 87

7.2 For Soils and Aggregates 87

7.3 For Cement and Cement Concrete 88

8.0 Casting Yard 88

9.0 Disputes 88

10.0 Maintenance after Defect liability period 88

1.0 Scope of Work

1.1 General

The Bruhat Bangalore Mahanagara Palike (BBMP) intends to construct ROB at Byappanahalli, Bangalore including construction of elevated Rotary fly over at IOC junction and construction of road integrating Banaswadi main road and Old madras road to facilitate connectivity to new M. Visvesvaraya terminal at Byappanahalli railway station to improve the accesses to all the directions of road, including construction of Pedestrian underpass at Rotary junction for movement of pedestrians. and to decongest the traffic at New terminal Railway station. As a part of that, BBMP has proposing to build 2- lane uni- directional additional Road Over Bridge at LC NO: 136A at Km 345/800-900 between Bengaluru Cantonment and Baiyyappanahalli Railway station with additional two Obligatory span parallel with existing obligatory span on Right hand and approaches on either sides of obligatory spans with viaduct and RE walls .

In this behest, BBMP is inviting Tenders from the Eligible Tenderers on Turnkey, Lump Sum, Fixed Price, No Variation basis based on Tenderer's own Design on the basis of Parameters fixed by the BBMP (Alternate Proposal is permitted and is limited to only one). The Alternate Proposal submitted by the Tenderer shall conform to the Relevant Indian and International Standards satisfying the Key Parameters fixed by the BBMP and shall be approved by the BBMP. Location of the Site is described in 1.2 below.

Tenderers shall submit only one Proposal. Additional Proposal / s shall result in the Disqualification of the Tenderer.

The Turnkey, Lump Sum, Fixed Price, No Variation Tender based on Tenderer's own Design shall be inclusive of Cost of Topographic Survey; Geotechnical Investigation and any other Ancillary Investigations / Works and Cost of all Labours; Materials; Casting Yard; Tools and Plants and Machinery required for Fabrications, Launching , completing the various Components of the elevated Rotary with composite super structure of Steel Box Girder at IOC junction connected with Ramps as shown in the concept drawings. Works along with ROB at LC No 136 A with additional 2 obligatory spans with composite I Girder and approaches ; Construction of grade road at all ramp approaches for Rotary and development of corridor between Baiyyapanahalli Railway station to Old Madras road NH-Junction including, Drainage Facilities; Footpath; Signals and Signages; Road Marking; Painting of all the Infrastructure developed; Illumination in / on the Grade Separators and on Surface Level Roads; etc. including Junction Improvement and Road Works like Preparation of Sub grade, Sub Base, Base, Riding Surface; Construction of Medians, Islands, Road Side Kerbs, BOX Culverts , Building civil works Guard room and ancillary works like compound wall for Defense wing and Railways and Temporary and Permanent Retaining Structures, etc. The Works shall include all Civil, Electrical, Mechanical, all Safety Aspects and any other Works required for the Construction and Completion of the Works in all respects and to the satisfaction of the Employer. **The Quoted Rate shall also be inclusive of Designs, Testing's, Construction and Maintenance of the Roads affected due to Traffic Diversions necessitated for this Work including Provision of Flagmen, Barricade, Illumination, Signals and Signages required for the Traffic Diversion.** The Quoted Rate shall be inclusive of all Taxes, Duties and Levies including Sales Tax, Municipal Taxes, Local Taxes, Octroi, ESI, all Royalties, Patent Rights, other Incidental Charges, and any other Taxes wherever applicable and shall be paid by the Contractor. No claim whatsoever in this regard shall be entertained by the Employer.

1.2 Site

The Construction Site is located about 13km east of Bengaluru Railway station at Byappanahalli at the IOC junction crossing the Railway lane. This junction will operate Major link between Banasavadi and Old Madras Road also Kammanahalli Main Road and Maruthiseva Nagar. The Location of the Project is indicated in **Drawing No. NEZPL/DWG/PRJ/204-1**

1.3 Works to be carried out

The Works to be carried out under this Turn Key, Lump Sum, Fixed Price, and No Variation Contract shall include

a. Preliminary Works like Setting out, Establishing and Maintenance of Permanent Benchmarks, Reference Points and Design , Preparation and obtain Approval of General Alignment of Elevated Rotary with connected Ramps to all the sides of Junction roads with approaches, And General Alignment for Additional Road Over Bridge parallel to existing at LC no 136A nearby New Railway station, Surface Level Roads / Slip Roads below the rotary ramps more than a Km, Corridor from elevated Rotary Junction and ROB towards Old Madras road covering about 2.50 Km , Drainage Facilities and all other Items of the Work.

b. Clearing of Site before Commencement of Work including Dismantling and Site Clearance at Acquired Government and Private Property, if any.

c. Topographical Survey and Setting out of Works.

d. **Geotechnical Investigations and taking Trial Bores**: The Geotechnical Investigation Results given in this Document is only indicative and the same is shown in the Tender drawing. The Tenderer shall make his own Assessment and his Lump Sum Offer is for the whole Item of the Work, (All the Items described in this Tender Document and Drawings) and for any Variations observed at Site in respect of Levels and Soil Particulars, etc. The Tenderer's offer is deemed to have been made considering the Actual Ground Conditions at Site and he shall not be eligible for any claim whatsoever. During Execution of the Work, the Contractor shall carry out Geotechnical Investigation as per IRC: 78 at all Piers / Abutments of Rotary and ROB for LC 136A, at Selected Points of Retaining Wall, and at any other Locations required for the Design of the Works in conformity to the Prevailing Norms and Codal Provisions.

e. The Successful Tenderer, on Award of Work, shall map all the Existing Service Lines, above and below the ground level within the Battery Limit, such as Water Supply, Underground Drainage, Electrical, Telephone, Optical Fibre Cables, etc. Mapping of the Service Lines below the Ground Level shall be carried out using Ground Penetrating Radar (GPR) Equipment. Mapping shall be got approved by all the respective Service Departments at the Risk and Cost of the Successful Tenderer.

f. Relocation of Services and Tree Transplantation Works shall be the responsibility of the Contractor. Further, all the Utility and Service Lines such as Water Supply, Underground Drainage, Electrical, Telephone, Optical Fibre Cables, etc. those are incidental and obstructing, are to be permanently diverted in an acceptable manner to the Concerned Service Departments so that not to hinder the Services of the Lines at the Cost of the Employer. The Shifting/ Supervision Charges / Deposits, if any, to be payable to the Concerned Government Departments shall be borne by the Employer. The Employer will help in Liaisoning with the Concerned Authorities regarding the Need to shift the Service Lines in case of requirement. Based on his own Investigations as mentioned in the above Clause the Contractor shall make his own Plan for Provision / Diversion of the Service Lines and ascertain the entire Scope of Work and other Required Details by himself and the Employer shall not take any responsibility other than remitting the shifting charges /Liaisoning with the Concerned Departments as stated above. The Time Schedule of 24 (Twenty Four) Months is inclusive of the Period of Utility Shifting also and no Extension of Time would be granted due to Delay in this Work. No Monetary Claim in whatsoever manner shall be entertained separately.

g. Removal and Relocation of Existing Bus Shelters within the Battery Limit, if any, to the Location within or beyond the Battery Limits as approved by the Employer.

h. Shifting of Existing Kerb Stones within the Battery Limit, if any, to the Location within or beyond the Battery Limits as approved by the Employer.

i. Removal and Relocation of Existing Traffic Signages and Signals within the Battery Limit, if any, to the Location within or beyond the Battery Limits as approved by the Employer.

j. Removal and Relocation of Existing Hoardings, Advertisement Boards and Appurtenant Structures within the Battery Limit, if any, to the Location within or beyond the Battery Limits as approved by the Employer.

k. Dismantling of Existing ROB at IOC junction and Disposal of Earth / Debris of existing RCC and Masonry Structures, PCC, existing Road Pavements, RCC / SSM Drainage Structures, Tree Roots, Culverts, Medians, Kerbs, Traffic Islands, Earth Retaining Structures, Ducts, Hoarding and Advertisement Boards and Appurtenant Structures, etc. required for the Execution of the Work.

l. Construction of Temporary and Permanent Earth Retaining Structures, Compound, Barrication, Fencing, Dewatering, Drainage Facilities and all Temporary Structures wherever required during Construction.

m. Regarding of existing Ground Levels to achieve the required Vertical Clearance for ROB, Drainages, etc. including Disposal of Excavated Earth and Debris to the Location identified by the Contractor where the same shall not cause Nuisance and shall be acceptable to the Authorities concerned, Construction of Temporary and Permanent Retaining Walls as per the Approval of the Employer.

n. **Traffic Diversion**: The Contractor shall ensure that the Traffic Movement during the Construction of the Works is properly diverted, maintained and obstruction to the Traffic Movement is kept to the minimum. The Traffic Diversion with all Cost of Men and Material is to form part of the Turn Key Lump Sum Contract. The Traffic Diversion shall include but not be limited to the following.

- Prepare Traffic Diversion Plan for different Phases of Construction and got approved from the concerned Police Department by the Contractor.
- All Necessary Arrangements required for Diversion of Traffic, Erection of Sign Boards, Cautionary Boards and Illumination, etc.
- Provide Road Markings, Drainage System, Footpath for the Diversion Roads.
- Provide Skilled Flagmen for Traffic Diversion as per the Requirement of Concerned Department.
- Provide Traffic Barricades with Blinkers, Reflective Tapes, Road Delineators, Traffic Cones, Portable Signages, Reflective Lights and other necessary Traffic Signage as required, as directed by the Concerned Authorities and as per the Specification.
- Provide required Sub Grade and Surface Treatments for the Diversion Roads based on IRC Standards before Traffic Diversion and maintain for the Smooth Flow of Traffic throughout the Construction Period as directed by the Employer.
- After Completion of the Work, the Diversion Roads are to be rehabilitated as per IRC Standards and provided with 40mm Bituminous Concrete irrespective of other Treatments provided earlier during Pre Construction and Construction Period of the Work.
- It is the responsibility of the Contractor to work out the actual Traffic Diversion Schedule in concurrence with the Requirements of the Concerned Department and execute the same during different phases of Construction.

- Pedestrian Facilities shall be provided for Diverted Roads and the Plan for Pedestrian Facilities shall be got approved from the concerned Police Department by the Contractor.

o. **Barrication around the Construction Area**

- The Contractor shall be required to keep the Site as Safe and Secure as possible at all times, including the Erection of Site Perimeter Hoarding, which shall also deter trespassers both adult and children alike, as per the Approval of the Employer.
- The Contractor shall provide a solid two metre high securely erected Barricade including Lights over Barricades at night around the perimeter of the Site as per the Approval of the Employer, with Agreed and Guarded Access and Egress Points for both personnel and vehicles.
- At each entrance to the Site, the Contractor shall erect a large Billboard warning all persons who enter the Site that they are required to wear the Appropriate Personal Protective Clothing and that no Unauthorised Access is allowed.
- Wherever the Barricade borders on Pedestrian Footpath, Lightings shall be provided to illuminate the Pedestrian Routes. The Positioning of the Barricade Line shall not reduce the Width of Pedestrian Footpath to less than 900mm.
- Site Perimeter Barricade shall be washed at least once a month and repainted at least annually.
- The Site Barricade shall need to be inspected on a regular basis in order to ensure that the Integrity of the Fencing is maintained at all times as far as practicable.

p. Providing and Erecting Project Information Display Board (minimum size 2.5m X 1.5m) at minimum ten (10) different locations in and around the Project Area as approved by the Employer.

q. The Successful Tenderer, on Award of Work, shall coordinate with KPWD, NHAI,Traffic Police, BDA, BESCOM, BSNL, BWSSB, BMRCL, Indian Railways, K-Ride, KPTCL, BBMP and other Agencies associated with the Construction of Works and comply with their Requirements. The Employer will provide assistance only.

r. The Successful Tenderer, on Award of Work, shall prepare a detailed General Alignment Drawing for Elevated Rotary with approaches at IOC Railway Junction and for Road Over Bridge at L C No 136 A, in consultation with the concerned Railway Department. Obtain approval for detailed GAD in principle by following the railway procedures by a) submitting GAD Checklist, b) detail estimate of Proposed Circular portion of elevated rotary in ROB portion & Obligatory portion of Railway crossing at LC 136, along with c) detailed soil investigation reports for each column of circular ROB portion duly signed by investigating authority with seal on each page, showing the reduced levels on top of each bore hole and showing SBC of soil of each type of soil strata etc., before commencing work. The Employer will provide assistance only.

s. Structural design and drawing work for Foundation, sub-structure, super structure, fabrication drawings as per relevant IRC, BIS and other codes for the Elevated Rotary and Road over bridge shall be prepared. However design and drawings along with launching schemes arrangements for non-standard drawings of Railways to be proof checked by Indian Institute of Technology /Science/National Institute of Technology is mandatory for submission to Railway department at the risk and cost of the Successful tenderer for getting approval for execution.

t. After proof checking by IIT/IISc/NIT, the tenderer shall got approved the detailed design and drawings of structures of Elevated Rotary and ROB from concerned Railway department and BBMP and prepare Good for construction (GFC) drawings as well as other drawings as require for construction of Elevated Rotary and ROBs including approaches and other necessary structures if any.

u. Construction of Elevated Rotary and ROB at LC No 136A including Foundations, Sub Structure, Super Structure for Via Ducts and Obligatory Span, Composite bridge, Construction of Reinforced Earth Retaining Walls, RCC Retaining Walls, Backfill between RE Walls / Retaining Walls, Soil Stabilization below RE Panels, Filter Media, Kerbs, Crash Barrier, Crash barrier for ROB at LC 136A as per requirements of Defense, Complete Drainage System with Down Take Pipes, Wearing Coat, Water Proofing, Hand Rails to Crash Barriers, Expansion Joints, Bearings, Painting, Deck and Surface Road Illumination, etc. complete in all respects as per MoRT&H / IRC / BIS Specifications.

v. Construction of Slip Roads and other Roads at Grade Level including Widening of Carriageway; Junction Improvements; Construction of Retaining Wall; Construction of Compound; Footpath with Heavy Duty Cobble Stone 60 mm thick Interlock Pavers of Approved Size, Shape and Colour with a minimum Compressive Strength of 281 kg / Sqm; Hand Rails; Drains; Medians; etc. complete in all respects as per MoRT&H / IRC / BIS Specifications. The Scope shall include all the above Works within the Battery Limit. The Battery Limits for the Junctions are indicated in Concept and Alignment plan **drawing no. NEZPL/DWG/PRJ/204-3** for Comprehensive plan of Elevated Rotary and ROB at LC 136A and development of Road corridors.

w. Improvements to Corridor from battery limits of rotary junctions to Old Madras road along the New terminal Byiyyappanahalli station including construction of Carriageway including Junctions, Median, Footpath, Shoulder Drain, Road Side Drain, Illumination, etc. complete in all respects as per MoRT&H / IRC / BIS Specifications.

x. The scope also includes construction of a compound wall of maximum 1300m for defense, 800m for railways and 300m for private individuals who will partially lose their property.

y. Commitment also includes civil work construction within the Railway property consist of a) Sewerage primary plant consist of Primary treatment consists of Equalization tank, flash mixer, clariflocculator, rapid gravity filter, disinfection tank and the sludge drying bed for approximate area of 4 sqmt b) Electrical control room for signal with a maximum area of 134 sqmt. c) Re construction of Railway Gowdan which is now abended, needs to be relocated and to be newly constructed as per plan of Railways with maximum of 210 sqmt.

z. Providing Gantry, Traffic Signals, Traffic Signages, Road Marking and Granite name plate engraver along with necessary Pedestals, Foundation Stone, Stone for Inauguration Ceremony as per Specifications and as per the Approval of the Employer.

aa. Necessary Drainage Arrangement as per Specification. The Levels and Dimension Details for Drainage Arrangement shown in the Tender Drawing are only indicative. The Contractor shall carry out the required Hydraulic Study and work out the Levels and Dimension Details for Drainage Arrangement based on the Hydraulic Study and get the Drawing approved by the Employer before Execution.

bb. Set up of Field Laboratory.

cc. Adequate Street Lighting / Junction Lighting Arrangements as approved by the Employer during Construction.

dd. **Removal / Disposal**: Removal / Disposal of Excess / Disused Earth, Soils, Debris and Materials from the Construction Site. Further, it is the responsibility of the Contractor to identify the Dumping Yard Location and to dispose the Excess / Disused Earth, Soils, Debris and Materials to the same identified Dumping Yard where the same shall not cause Nuisance and shall be acceptable to the Authorities concerned.

ee. Dewatering in Foundation, Trenches, Drainages, wherever required, and pumping out to Locations as directed by the Employer.

ff. All Necessary Safety Measures / Precautions to be adopted at Site as per the Instructions of the Employer.

gg. Providing and maintaining Furnished Site Office for the Supervisory Staff of the Employer and his approved Representative.

hh. Making good the Road Surface as per IRC Standards, which are damaged / worn out during Construction of the Work and restoring the same to the Original Status.

ii. Any other Items of Works, which are not specifically enumerated in the Tender Document, but required for Functioning of all the Infrastructures Developed and as per the Directions of the Employer.

jj. Construction of Architectural Features required for Good Aesthetics of the Infrastructure developed.

kk. Painting with Approved Colour, Shade, Make and Type shall be provided for the various Elements as per the Specifications given in the Tender Document.

ll. The Contractor shall ensure Cleanliness of the Work Area and its surroundings by deploying Man Power for the same. The Contractor shall have to ensure proper Brooming, Cleaning and Washing of Work Area till the Currency of the Contract including Disposal of Sweepage. Nothing extra shall be payable on this account

.

mm. Cleaning of the Site after Execution and before handing over the Project to the Employer.

nn. Maintenance of all the Infrastructural Facilities developed for a Defect Liability Period of 24 months, which will run concurrently from the Date of the Physical Completion of the Project and on issuance of Completion Certificate by the Competent Authority and for a Maintenance Period of 36 months, which will run concurrently from the next day of Completion of Defect Liability Period and on issuance of Defect Liability Completion Certificate by the Competent Authority. For maintenance of steel bridge and other components refer Indian Railways Bridge Manual-1998.

oo. The detailed scope of work as mentioned in the tender document and as assessed in the estimate will be finalized during the award of work.

2.0 Design Criteria

2.1 General and Approach to Work Site

The General Site Particulars are shown in the Topographical Map. Refer Tender Drawings no. **NEZPL/DWG/PRJ/204-2**

2.2 Benchmarks and Setting out of Works

a. The Standard Benchmark and its Reduced Level with reference to which the Work shall be carried out is the GTS Benchmark available nearest to the Site. The Employer does not take the responsibility about the Correctness of the Levels indicated in the Drawings. The Contractor has to establish at least fifteen Benchmarks in the Site of Works with Reduced Levels clearly marked on them. The Contractor shall be solely responsible for the accuracy of the Benchmark Levels and for maintaining the same throughout the Contract Period.

b. The Works shall be set out in accordance with the Drawings approved by the Employer.

c. The Contractor shall be responsible for the True and Proper Setting out of the Works and for the Correctness of the Positions, Levels, Dimensions and Alignments of all Parts of the Works and for the Provision of all Necessary Instruments, Appliances and Labours in connection therewith. The Contractor shall give at least 48 hours notice to the Employer of his intention to set out or give Levels.

d. If at any time during the Progress of the Work, any Error appears or arises in the Positions, Levels, Dimensions and Alignments of any part of the Work, the Contractor shall at his own expenses and risk, rectify such Errors to the satisfaction of the Employer.

e. The Checking of any setting out of any line or level by the Employer or his approved Representative shall not relieve in any way the Contractor of his responsibility for the Correctness thereof and he shall carefully protect and preserve all the Benchmarks, Site Rails, Pegs and other Things used in the setting out of Works.

f. All Duties concerning Establishment of a Set of Benchmarks, Permanent Stations, Centre Line Pillars, etc. for performing all the Functions necessary at the Commencement and during the Progress of Work till the Physical Completion of all the Items of the Work in question, shall be carried out by the Contractor at his own risk and cost.

f. The Centre Line of the Elevated Rotary and its approaches, ROB, Piers of Flyovers, Abutments, RE Walls, Surface Level Roads / Slip Roads, Corridor, Electrical room for Railways, Drainage Facilities and the Foundations shall be established by Total Station Equipment and the Centre Line Marks shall be engraved on smoothly finished masonry or concrete pillars of such dimensions and constructed at such intervals and places as may be directed by the Employer or his approved Representative and shall be maintained in proper manner throughout the Period of Construction. The Contractor shall submit a Drawing showing the Alignment of Elevated Rotary Flyovers, Road Over Bridge, Surface Level Roads / Slip Roads, Corridor and Drainage Facilities within 15 (fifteen) days from the Date of Signing of Agreement.

g. He shall also keep proper Record of such Permanent Benchmarks established denoting therein their Correct Levels.

h. The Work of Establishment of all such Benchmarks shall be carried out by only experienced and skilled staff of the Contractor with the help of precise instruments suitable for this type of Work. The instruments used shall be checked for their accuracy and for permanent adjustments before the commencement of the Work and also at frequent intervals during the progress of the Work.

j. All such Benchmarks established by the Contractor shall be subject to check and approval of the Employer or his approved Representatives. If any Variations noticed in the Work as result of improper establishment or maintenance of such Benchmarks, it shall be rectified at the Contractor's own Risk and Expense.

2.3 General Requirements

In order that the Tenderer's Proposal qualifies as an Alternative Design, it shall generally fulfill the following Requirements.

a. It shall ensure Soundness of the Structure, its Durability and Aesthetics as a whole in harmony with the surroundings. A Report on the Aesthetic Aspect shall be compulsorily in the Technical Bid.

b. It shall ensure Speedy and Practicable Construction.

c. It shall lead to Appreciable Economy in the Design.

d. It shall be accompanied by Detailed Drawings and Detailed Description of Work and Specification of Materials and Items. If called upon, the Tenderer shall explain his Proposal through Power Point Presentation

during Tender Evaluation Stage before Opening of Financial Bid.

e. At the time of Detailed Design, the Contractor shall not deviate from the Basic Scheme proposed by him for the purpose of Tender. At the same time, it is mandatory on the part of the Contractor to strictly adhere to all the Geometric Details indicated in the Tender Drawing. The Length of the Ramp could marginally change based on Structural Scheme and Designs after Approval by the Employer.

f. The Alignment of the Elevated Rotary Flyovers, Road Over Bridge, Surface Level Road and Drainage Facilities, Electrical/Godown rooms building and ancillary works for Railways , compound wall shown in the Drawings appended with the Tender Document shall be followed by all the Tenderers, and if Any alteration / modifications in alignment plan is proposed by the bidder in the better way resulting with further reduction of the cost of land acquisition and project cost will be subjected to employer approval,

g. The Superstructure shall have required numbers of Expansion Joints for better Riding Surface.

h. Only Single Pier Type Structure shall be considered for Elevated Rotary Flyovers, Pier Shape shall be aesthetically pleasing, preferably elliptical / circular / ornamental Piers of Classical Design, etc. In this regard, the Decision of the Employer is final and binding.

i. The Tenderer shall note that it is a Requirement for Qualification that the Works warrant that the Structure proposed shall be aesthetically pleasing and easy to maintain considering the Importance of the Work Location.

2.4 Specifications for Design and Codes to be followed

The Design of Structural Components of all the Works shall conform to the Relevant Specifications and Criteria laid down in the following Latest Indian Road Congress Publications with Amendments / Revisions issued up to the Date of Issue of Notice Inviting Tenders.

The Hierarchy for the following Codes of Practice is as follows:

a.

IRC: 5	General Features of Design
IRC: 6	Loads and Stresses
IRC: 15	Construction of Concrete Roads
IRC: 18	DESIGN Criteria for Pre-stressed Concrete Road Bridges (Post-Tensioned Concrete)
IRC: 21	Standard Specifications and Code of Practice for Road Bridges.
IRC: 22	Composite Construction (Limit State Design)
IRC: 24	Steel Road Bridges
IRC: 35	Road Markings
IRC: 37	Design of Flexible Pavements
IRC: 38	Design of Horizontal Curves for Highways and Design Tables
IRC 39	Standards for Road-Rail Level Crossing (I Revision).
IRC: 44	Cement Concrete Mix Design for Pavements
IRC: 54	Lateral and Vertical Clearances at Underpasses for Vehicular Traffic
IRC: 58	Design of Plain Jointed Rigid Pavements for Highways
IRC: 65	Recommended Practices for Traffic Rotaries
IRC: 67	Road Signs

IRC : 71	Abbreviations and Symbols in Documents and Plans.
IRC: 78	Foundation and Substructure
IRC: 79	Road Delineators
IRC: 83 (Part I)	Metallic Bearings
IRC: 83 (Part II)	Elastomeric Bearings
IRC: 83 (Part III)	POT, POT cum PTFE, PIN and Metallic Guide Bearings
IRC: 86	Geometric Design Standards for Urban Roads in Plains
IRC: 92	Designs of Interchanges in Urban Areas
IRC: 103	Pedestrian Facilities
IRC: 112	Concrete Road Bridges
IRC SP 19	Manual for Survey, Investigation and Preparation of Road Projects.
IRC: SP: 23	Vertical Curves for Highways
IRC :SP: 37	Guidelines for Evaluation of Load Carrying Capacity of Bridges.
IRC: SP: 42	Road Drainage
IRC: SP: 50	Urban Drainage
IRC: SP: 56	Steel Pedestrian Bridges
IRC: SP: 57	Quality Systems for Road Construction
IRC: SP: 90	Manual for Grade Separators and Elevated Structures
MoR:	Indian Railways Bridge Manual-1998
IS: 2911 (All Parts)	Pile Foundations

The Latest Revision of the above Codes shall be followed.

b. Any IRC Standard Specifications and Codes of Practice or Criteria for Road Bridges other than "a" above, but published upto the Last Date of the Issue of Notice Inviting Tender.

c. For any Item not covered by “a” and “b” above, MoRT&H Specifications for Road and Bridge Works published by Ministry of Surface Transport (Roads Wing), Government of India (Latest Edition).

d. For Items not covered by any of the “a”, “b” and “c” above, Standards and Specifications, Provisions of Bureau of Indian Standard (BIS) Codes of Practice.

e. IRC: SP: 33 Guidelines on Supplemental Measures for Design, Detailing and Durability of important Bridge Structures (if applicable).

f. For Items not covered by any of the above Standards and Specifications, Sound Engineering Practice and Provisions of Relevant Codes of other Nations shall be referred. In this regard, Decision of the Employer shall be final and binding on the Contractor.

2.5 Order of Precedence in case of Conflict

In Case of Conflict between difference parts of Tender Document, the following Order of Precedence shall

prevail.

1. Design Criteria as specified in Tender Document.
2. Instructions to Tenderers.
3. Special Conditions of Contract.
4. General Conditions of Contract.
5. MoRT& H / IRC Specifications.
6. Codes of Practice.

2.6 Soil Investigation to be carried out by the Contractor

The Contractor shall carryout complete Soil Investigation at his own risk and cost. The Boreholes shall be taken at the Final Locations of each Pier / Abutment, at Selected Points of Retaining Wall, at elevated Portion of Rotary/Road Over bridge and at any other Locations required for the Design of the Works prior to the Commencement of the Work to ascertain the Levels of Rock and its Quality, to obtain SBC at different Depths, Soil Stratification, Ground Water Table, etc. The Termination Level of the Borehole shall be determined by conducting SPT Tests. Three consecutive SPT Tests at an interval of 1.5m each with 'N' values greater than 100 shall be carried out before termination. If rock is encountered, Drilling shall continue upto 3m in rock with Rock Samples taken for Testing. All the Soil / Sub Soil Investigations and its Frequency shall be strictly in accordance with the Relevant Codal Provisions.

a. During Execution of the Work, the Samples from the Bore taken at each Foundation shall be tested and analysed in the Laboratory approved by the Employer for establishing Design Parameters. Tests such as Standard Penetration Test, Compression and Shear Test on Undisturbed Soil Samples, Pressure Meter Test, Crushing Strength of Rock, California Bearing Ratio (CBR) Test, Plate Load Test, etc. shall be carried out in conformity with the MoRT&H Specifications. The Contractor shall submit the entire Data to the Employer along with his own / Laboratory Recommendations and obtain approval for the Design Parameters. Necessary Interpretation of the Result of Tests shall be furnished to the Employer for scrutiny of Design of Foundations.

b. The Cost of these Tests and Interpretation of the Test Results shall be considered, as incidental to the Main Work and the same shall be included in the Tendered Amount.

c. While checking the Stresses at the Base of Foundations, it shall be ensured that under the Worst Combination of Forces no Tension is permitted. The Safe Bearing Capacity at the Foundation Level shall be verified during Construction so that to ensure that the Stresses imposed on the Foundation Strata are within Permissible Limits.

2.7 Restrictions on Type of Structures

The following Types of Structural Arrangements shall not be permitted.

a. Structures, which require imported material of major quantity for which foreign exchange will have to be arranged by the Employer.
b. A Design in which Stability of one or more Span is endangered due to the Failure of some other Span / Spans.
c. Concrete Structures with Hinges / Half Joints / Articulations.
d. Super Structures with Joints at the tips of long cantilevers with Hinges including Pendulum Type Bearings, Gap Slab, etc.
e. Transversely Continuous Wide Deck resting on separate Foundations at Support Locations.
f. Piers in the form of Multiple Columns or "Y" Columns.

2.8 Concept and Alignment plan of Elevated Rotary Flyover and ROB at LC No 136A

The concept and alignment plan of elevated rotary proposed at IOC junction with its approaches integrating with at grade road proposal up to NH junction at old madras road including proposal of New ROB at LC No 136 has been prepared and enclosed as stated elsewhere. Concept plan with alignment is prepared keeping in view of

minimum land acquisition both in private and government properties. The land acquisition plan no NEZPL/DWG/PRJ/204-5 also enclosed to understand the proposed right of way. The successful tenderer shall follow the concept plan for profile design within the proposed right way shown in LA plan without changing the concept. If there is any deviation in concept plan tenderer shall obtain prior approval from BBMP before commencement of design.

2.8.1 Elevated Rotary Flyover and Pedestrian Underpass

An elevated rotary of Four lanes unidirectional type flyover has been proposed at IOC Railway Junction where rail crosses the sub arterial road of Banasavadi- Maruthisevanagar in one direction and Kammanahalli to Old madras road in another direction which connects the Outer Ring road and National Highways 4 & 7 respectively and junction is very close to New Baiyappanahalli terminal Railway Station. Approaches to railway maintenance shed are proposed within the railway boundary near the junction. The rotary has been designed to connect the four arms of the cross road with approaches. The Salient Features of the Elevated Rotary Flyovers with Approaches are given below. Lengths of approaches shown below are tentative and may vary depending on ground levels at the time of detailed design.

- **Elevated Rotary at IOC Junction**

Number of Lane	: 4 lanes unidirectional
Total width of Elevated Rotary	: 15.0m
Minimum Carriageway Width	: 14 m
Minimum Vertical Clearance	: 6.525m
Radius of the Rotary	: 32.50m
Circumferential length at C/L of Rotary	: 255.0m
	: 1 x 81.31m
Viaduct Span with Steel Box Girder	: 1 x 68.50m
	: 1 x 56.00m
	: 1 x 48.00m
Shape of Steel Box Girder	: Trapezoidal shape Open at Top
Number of Box Girder at each span	: 3

Further, Length of elevated rotary viaduct span has been fixed in consultation with sub-urban railway department K-Ride to minimize the interference of Piers with the proposed railway lane and to minimize the railway land at grade. Length of Viaduct Span shall be maintained with all other Requirements such as Protection to the Piers, etc. as indicated in the Tentative General Alignment Drawing no. NEZPL/DWG/PRJ/204-4 - 1 to 4 including Plan and Section details of all the Railway Spans**.** Further, Extra Widening of Carriageway at Curve Portion as per IRC: 86 with Design Speed of 30 kmph shall be provided.

- **Approaches to Elevated Rotary at IOC Junction**

  - **Four lane Up/Down ramp approach to Rotary from Banasawadi road**

Number of Lane	: 4 lanes divided bi- directional
Total Width of approaches	: 17.0m
Minimum Carriageway Width	: 2 X 7.5m
Median	: 1.0m
RCC Crash barrier	: 2 x 0.5m
Maximum Vertical Gradient	: 5% (1 in 20)
Length of Approaches	: 205.0 m
Length of Viaduct Span	: 4 x 30.00m
Length of End spans	: 1x20.0m
Length of Solid Ramp	: 65.0 m

  - **Two lane Up ramp approach to Rotary from Banasawadi road**

Number of Lane	: 2 lanes uni- directional
Total Width of approaches	: 8.5m

Minimum Carriageway Width	: 1 X 7.5m
RCC Crash barrier	: 2 x 0.5m
Maximum Vertical Gradient	: 5% (1 in 20)
Length of Approaches	: 205.0 m
Length of Viaduct Span	: 4 x 30.00m
Length of End spans	: 1x20.0m
Length of Solid Ramp	: 65.0 m

- **Up/Down ramp approach to Rotary from Kammanahalli side**

Number of Lane	: 4 lanes divided bi- directional
Total Width of approaches	: 17.0m
Minimum Carriageway Width	: 2 X 7.5m
Median	: 1.0m
RCC Crash barrier	: 2 X 0.5m
Maximum Vertical Gradient	: 5% (1 in 20)
Length of Approaches	: 205.0 m
Length of Viaduct Span	: 4 x 30.00m
Length of Solid Ramp	: 85.0 m

- **Down ramp Towards Baiyappanahalli Terminal Railway station & Up ramp to Rotary from Indiranagara (Old Madras road)**

Number of Lane	: Two lane unidirectional
Total Width of approaches	: 8.50m
Minimum Carriageway Width	: 2 X 3.5m
RCC Crash barrier	: 2 X 0.5m
Maximum Vertical Gradient	: 5% (1 in 20)
Length of Approaches	: 205.0 m
Length of Viaduct Span	: 4 x 30.00m
Length of End spans	: 1x20.0m
Length of Solid Ramp	: 65.0 m

- **Central Down ramp from rotary to Baiyappanahalli Terminal Railway station beyond and towards Old Madras road**

Number of Lane	: Two lane unidirectional
Total Width of approaches	: 8.50m
Minimum Carriageway Width	: 2 X 3.5m
RCC Crash barrier	: 2 x 0.5m
Maximum Vertical Gradient	: 5% (1 in 20)
Length of Approaches	: 1150.00 m
Length of Viaduct Span	: 33x 30.00m
Length of Solid Ramp	: 160.0m

- **Up/Down ramp approach from Rotary to Maruthisevanagara road**

Number of Lane	: 4 lanes divided bi- directional
Total Width of approaches	: 17.0m
Minimum Carriageway Width	: 2 X 7.5m
Median	: 1.0m
RCC Crash barrier	: 2 x 0.5m
Maximum Vertical Gradient	: 5% (1 in 20)
Length of Approaches	: 1496.0 m
Length of Viaduct Span	: 47 x 30.00m
Length of Solid Ramp	: 86.0 m

➢ **Up/Down ramp approach from Rotary to Railway Maintenance Shead**

Number of Lane	: Intermediate lane bi-directional
Total Width of approaches	: 7.0m
Minimum Carriageway Width	: 1 X 6.0m
RCC Crash barrier	: 2 x 0.5m
Maximum Vertical Gradient	: 5% (1 in 20)
Length of Approaches	: 210.00 m
Length of Viaduct Span	: 4 X 30.00m
	: 1 X 20
Length of Solid Ramp	: 70.0m

Typical Cross Section of Approaches to Rotary are shown Tender Drawings attached.

Further, approach to railway maintenance shed is proposed from rotary for railways employees only with an intermediate carriage way and allowed for bidirectional flow as indicated in the **Drawing no NEZPL/DWG/PRJ/204-4-4** Further, Extra Widening of Carriageway and Super Elevation at Curve Portion as per IRC: 86 with Design Speed of 40 kmph shall be provided.

Pedestrian Underpass

The facility of footpaths for pedestrian movements has not been proposed on elevated rotary/approaches to avoid pedestrian conflicts with vehicular traffic. To facilitate pedestrians to cross the railway line, a separate pedestrian underpass is proposed below the rotary to meet the railway safety requirements.
The Salient Features of the Pedestrian Underpass with Approaches at Railway crossing are given below.

➢ **Proposed Pedestrian Underpass**

Length of Pedestrian Underpass	: 152m (considering future track)
Type of Structure	: RCC Box type
Width of PUP	: 5.2M
Clear height of PUP :	2.75M
Earth cushion over slab	: 0.5m
Rail with Ballast on earth cushion	: 0.75m
Entry/Exist to PUP	: Steps and Ramp width of 1.2m

Typical Cross Section of PUP at IOC Junction Railway Crossing Below Rotary is enclosed in the Tender drawing .

2.8.2 Road Over Bridge

Additional Road Over bridge is proposed for LC No:136A at KM 345/800-900 between Bengaluru Cantonment and Baiyappanahalli Railway Station . Railway department has recently constructed Road Over Bridge for this LC No: 136A with two lane configurations, BBMP and Railway is now taken up to construct additional Road Over Bridge with same configuration of existing one which has constructed recently. Obligatory span is with composite girders with two spans at railway lane portion are proposed as existing ROB on RHS. The Salient Features of the New ROB with Approaches and Additional composite girder at Railway crossing are given below

➢ **Proposed Road Over Bridge at LC No: 136A on LHS of Existing Obligatory span**

<u>Obligatory Railway Span</u>

Number of Lane	: 2 lanes unidirectional
Number of Span	: 2 x 35m
Total width of ROB	: 12.0m
Minimum Carriageway Width	: 1 X 7.5m
Kerb	: 2 x 0.55
Footpath	: 2 x 1.5m
Crash Barrier	: 2 x 0.20m
Vertical Clearance	: 6.525m
Camber (bi-directional)	: 2.5%

Approaches to Obligatory Railway spans

a) Towards Byyappanahalli Railway station

Total Length of Approach	: 175.0m
Viaduct Length	: 91.5m
RE- Wall Solid approach	: 83.5m
Number of Viaduct Span	: 3 x 30.5m
Number of Lane	: 2 lanes unidirectional
Total width of Approach	: 8.5m
Minimum Carriageway Width	: 2 X 3.25m
Crash Barrier	: 2 x 0.5m
Vertical Clearance	: 6.525m
Maximum Vertical Gradient	: 5% (1 in 20

b) Towards Old Madras side

Total Length of Approach	: 465.0m
Viaduct Length	: 274.5m
RE- Wall Solid approach	: 190.5m
Number of Viaduct Span	: 9 x 30.5m
Number of Lane	: 2 lanes unidirectional
Total width of Approach	: 8.5m
Minimum Carriageway Width	: 2 X 3.25m
Crash Barrier	: 2 x 0.5m
Vertical Clearance	: 6.525m
Maximum Vertical Gradient	: 5% (1 in 20)

The Structural Configuration for the Road Over Bridge and Approaches is shown in Tentative General Alignment **Drawing no NEZPL/DWG/PRJ/204-4-5 to 6 .**

The Design Criteria and Viaduct Requirements to be adopted for the Tenderer's Proposal are furnished in the next Section. The Viaduct Portion for Rotary, ROB and Approaches Span shall not be less than as indicated in the **Drawing No. NEZPL/DWG/PRJ/204-4-1 to 4 for** ROTARY Junction and **Drawing No. NEZPL/DWG/PRJ/204-5 to 6 for** ROB at LC No 136A respectively and shall have a Minimum Vertical Clearance of 6.525 m between bottom level of Soffit and Rail Formation Level.

The Work of Construction of Elevated Rotary Flyovers and ROB to be carried out under this Contract Shall include the following.

a. Construction of Elevated Rotary Viaduct and its approaches and ROB AT LC 136A viaduct and its approaches complete with Disposal of Surplus Earth; Wearing Coat over Deck; Crash Barrier with Railing over it; Construction Joint; Expansion Joints between Viaducts, Approach Slab, etc. and complete as per Specifications mentioned in the Tender Document.

b. Construction of Reinforced Earth Retaining Walls along with Approach Slabs, Friction Slabs; Pavement over Earth Filling and Ramp Terminal on either side; Side Drains for the Approaches as per the Requirements; Backfilling with Filter Media, Retaining Walls as per the Requirement; Disposal of Surplus Excavated Earth; Crash Barriers with Railing; Expansion Joints in Retaining Walls, Approach Slabs, etc. as per the Specifications mentioned in the Tender Document.

c. Wearing Coat of the Deck Portion of the Flyovers/ROB comprises of 25mm thick Mastic Asphalt and shall be placed before Laying of 40mm Bituminous Concrete (BC) after the Application of Tack Coat.

d. The Pavement of Solid Ramp Portion shall comprise of 150mm thick Granular Sub Base (GSB), 160mm thick M-40 Grade.

e. Steel crash barrier raised over RCC crash barrier ramp towards old madras road side for ROB at LC 136A in defense land as per requirement of Defense.

f. Construction and Painting of Kerbs, Steel Girders, Concrete Structures of Rotary & ROB , Providing Over Head Gantry at all 4 sides approaches and 2 sides at ROB locations, Traffic Signage's, Road Marking such as Lane Marking, Direction Marking, etc. as per the Specifications mentioned in this Tender Document.

g. Illumination above and below Flyovers as per the Specifications mentioned in this Tender Document.

2.8.3 Design Data

Design of Elevated Rotary Flyovers/Approaches/ROB shall be based on latest IRC / BIS Codes, Special Publications by IRC, relevant and latest Ministry Circulars and Latest Edition of MoRT&H Specifications.

a. **Location**

The Locations of the Elevated Flyovers and Road Over Bridge are given in the Drawings as mentioned in Clause No. 1.2 of this Section.

b Type of Bridge

Elevated Rotary flyover is proposed for design as curved bridge with Steel box Girder of Trapezoidal in shape is proposed as the span arrangements are more than 50m and longest is 82m. The torsional properties of the closed section is advantageous in this type in reducing and simplifying the support arrangements and are also extremely efficient in carrying torsional loads found in this type of curved bridge and these bridges special analysis and detailing are required.

Type of bridge proposed for ROB at LC no 136A is composite I Girder.

c. **Road Geometrics**

Elevated Rotary Geometrics should be based on IRC: 65 Recommended Practices for Traffic Rotaries. The Standards for Road Geometrics adopted in the Design of the Viaducts and Ramps should be essentially based on IRC: 92 "Guidelines for the Design of Interchanges in Urban Areas" and the Salient Features are as follows.

i. **Vertical Gradient**

Maximum allowable Vertical Gradient for all Entry and Exit Ramps shall be limited to **5% (1 in 20)**.

ii. **Clearances**

Minimum Vertical Clearance between Rail Formation Level and bottom level of Soffit of Elevated Rotary Flyovers/ROB shall be 6.525m as per Hand book on Railway Construction under clause 10.2.2 selection of ROB/RUB Parameters mentioned at Page no 369.

iii. **Elevated Rotary Design**

Rotary design should be based on the traffic operations of diverging, merging and weaving. The design elements include design speed, radius at entry, exit and the central island, weaving length and width, entry and exit widths should be as per IRC-65. The Radius of Rotary should be designed with minimum radius of 1.3 times of entry curve. The entry to the rotary should not be straight, but a small curvature of about 20 and 25 metres to be introduced. The exit radius should be 1.5 to 2 times than the entry radius of the rotary so that the vehicles will discharge from the rotary at a higher rate. The width of the weaving section should be higher

than the width at entry and exit preferably between 6 to 18m and weaving length available at the intersection should be between 18 to 90m. The traffic rotary shown in concept and alignment drawing no NEZPL/DWG/PRJ/204-3 is designed as per standards and is reducing the complexity of crossing traffic by forcing them into weaving operations.

d. **Minimum Viaduct Span**
Minimum Span of Viaduct adopted shall not be less than as indicated in the **Drawing No. NEZPL/DWG/PRJ/204-4-1 to 4** and **Drawing No. NEZPL/DWG/PRJ/204-5 to 6** respectively **for Rotary and ROB** and shall be approved by the Employer.

d. **Obligatory Span**
Minimum Length of Obligatory Span for Railway Crossing shall be as shown in the **Drawing No. NEZPL/DWG/PRJ/204-4-1 to 4** and **Drawing No. NEZPL/DWG/PRJ/204-5 to 6**

e. R**equirement of Steel Box Girder**

The recommended minimum web depth for web girder is 1.5m is requirement for inspection accessibility. The minimum width for the girders bottom flange width is 1.2m to allow for workers to complete fabrication of various internal girder details. The average distance center to center of flanges of adjacent boxes shall not be greater than 1.2 times and not less than 0.8 times the distance center to center of the flanges of each box.

Bottom tension flanges is designed with 30mm thick and web plate with 30mm (may varies as per actual), the minimum thickness of web plate should not be less than 8mm. Girders should be designed with Internal K-Frames to control distortion of the box girder. The provision of opening in the middle facilitates access in walking down the middle of the box during construction or routine maintenance inspections. Wide flanges also need to be stiffened to carry sufficient load and to avoid buckling.

Steel work of girders should be Metalizing with sprayed aluminum after surface preparation by Sand/grit blasting, followed by one coat of etch primer (IS:5666) & one coat of Zinc Chrome primer (IS:104) and two coats of aluminum paint (IS:2339) duly conforming to all relevant specifications and process given under Clause 39 of IRS-B1-2001.

Since Rotary is significant plan curvature, single bearings of spherical type be used at all supports, since the curvature of the line of supports generates torsional restraint.

The Initial design of Steel Box Girder is detailed in Drawing No NEZPL/DWG/PRJ/204-4-1 to 3

2.8.4 Description of Work and Viaduct Provisions for Alternative Proposals

a. **Alignment and Location**
The Alignment, Longitudinal Section and Obligatory Portion should be in accordance as shown in **Drawing No. NEZPL/DWG/PRJ/204-4-1 to 4** and **Drawing No. NEZPL/DWG/PRJ/204-5 to 6** Respectively for Rotary and ROB and shall be got approved by the Employer.

b. **Layout of Flyovers**
The Layout of Flyovers shall satisfy the following criteria as indicated on the enclosed Drawings and Supplementary Data.

i. Minimum Vertical and Horizontal Clearance in the Rail Location.
ii. Minimum Length to be covered by Open Spans as required from Consideration of Aesthetics and from Visibility for Low Level Traffic.
iii. Ruling Gradient.
iv. Minimum Length of Summit Curve as 30.00m and Valley Curve as 30.00m shall be adhered to.
v. Any other Criteria as shown on the Drawings.

c. **Road Level on the Flyovers and Roadway Particulars**

i. The proposed Road Particulars and Carriageway Widths shall be as per **Drawing No. NEZPL/DWG/PRJ/204-4-1 to 4 and Drawing No. NEZPL/DWG/PRJ/204-5 to 6 Respectively for Rotary and ROB.**

ii. The Vertical Profile of the Finished Surface of Deck Slab and Wearing Course shall be in the form of a smooth curve where change in Gradient occurs. The Design of Curves (Vertical / Horizontal) shall be approved by the Employer. The Design Speed shall be 40 km / hr. Super Elevation, Camber and Widening on Curves shall be suitably considered. Super elevation need not be provided for elevated rotary flyover.

2.8.5 Design Loads

a. **Live Load**

The Elevated Rotary Flyovers shall be designed as per IRC: 6 (Latest Edition).

b. **Wind Forces**

Wind Forces shall be considered as per IRC: 6 (Latest Edition).

The Appropriate Wind Force on 9m high Lighting Pole @ 25 m c / c shall be considered in the Design.

c. **Seismic Force**

The Flyovers shall be designed for Appropriate Seismic Force as per the Provisions of IRC: 6 (Latest Edition).

d. **Earth Pressure**

i. The Soil Properties for Embankment shall be in accordance with MoRT&H Specification. The Properties of Embankment like Dry Density of Soil 1.85 t / cum; Saturated Density 2.00 t / cum.; $\Phi = 300$ and $C = 0$ shall be considered for Tendering Purpose. At the time of preparation of Final Design, Soil Parameters shall be considered based on the Test Results of the Approved Material.

ii. Saturated Density of the Backfill (minimum 2 t / cum.) shall be considered for calculating Active Earth Pressure for Tendering Purposes.

e. **Temperature Range**

i. For Design of Structure to account for Temperature in Formula, $(DL) = \alpha Lt$
The value of "t" shall be $\pm 17^0C$
Where α = Coefficient of Expansion or Contraction
L = Length of the Member
(DL) = Expansion / Contraction due to Temperature Variation in appropriate Units.

ii. The Superstructure shall also be designed for Effects of Distribution of Temperature across the Deck Depth. For Calculation of Thermal Forces Effect of 'E' Value of Concrete shall be taken as 50% of the Instantaneous Value so that to account for Effects of Creep on Thermal Strains.

2.8.6 Durability

a. Minimum Grade of Concrete shall be as below.

PCC for Levelling Course	M15
RCC for Open Foundation, and Sub Structure and Super Structure	M35
RCC for Super Structure	M45
RCC for Pile and Pile Cap	M35
Prestressed Concrete	M45

b. **Minimum Cement Content, Diameter of Bar and Cover Requirements**
For Plain Cement Concrete (PCC), Reinforced Cement Concrete (RCC) and Pre Stressed Concrete (PSC), the Value given below regarding Minimum Cement Content and Maximum Water Cement Ratio shall be followed.

Plain Concrete		**RCC / PSC**	
Minimum Cement Content Kg / cum.	Maximum Water Cement Ratio	Minimum Cement Content Kg / cum.	Maximum Water Cement Ratio
240	**0.45**	**420/440**	**0.45 / 0.40**

c. The Minimum Nominal Diameter of Reinforcement shall be 8mm.

d. The Minimum Clear Cover to Reinforcement for all Grades of Concrete shall be as below.

Structural Element	**Clear Cover**
Slab	40mm
Web / Column	40mm
Footing / Raft slab	75mm
Cable Duct	75mm
Pile Foundation	75mm

2.8.7 Foundation

Planning of foundations: Deep foundations are, in general, costlier as compared to the open foundations. The Elevated Rotary and ROBs locations don't have water flowing around them, so scour is not a concern and the depth of foundation can be kept smaller also. If the soil conditions dictate or there is some other advantages like ease of construction, reduction in duration of caution order, during that time must go in for deep foundations like piles. If such constraints are not there open foundations shall be adopted, if feasible from bearing capacity considerations.

a. **General**

The Soil strata at the location of construction of Elevated Rotary and Road over Bridge at LC No: 136A is very hard and stiff with Non- cohesive soil. As could be seen from the geotechnical investigation indicated in the tender drawing, the hard strata could be seen below the ground at a depth of 3-6m with N- value greater than 100. At few locations the hard strata starts varies to a depth of 10 to 13m.

Generally, Open foundation is considered to the extent of twenty five percent of foundation for sub structures and balance area where strata of good bearing capacity is not available near the ground, the space is restricted to allow for spread/open foundation, in those cases the foundation of the structure has to be taken deep with the purpose of attaining a bearing strata which is suitable and which ensures strictly and durability of structure. The details of the deep foundation to be provided and Open foundations are given below.

The Piles shall be bored Cast – in – Situ type and socketed into rock. The Construction of Pile Foundation shall conform to relevant Specifications of IS: 2911 unless specified otherwise in the Documents.

b. **Quality of Pile Concrete, Pile Caps, etc.**
The Grade of Concrete for the Pile shall be minimum M35. The Cement Content for Piling Work shall be minimum 390 kg / m^3 with Ordinary Portland Cement.
Grading and other Requirements of Coarse and Fine Aggregates, Water and Concrete shall be as specified for Concrete Works in the Contract Document.

c. **Length / Dia of Pile**

The Piles are essentially End Bearing and shall be socketed into the Hard Strata at least to a Depth as recommended in IRC: 78 (Latest Edition). The Presence of Hard Strata shall be established by conducting SPT Tests in the Pile Bore. These Tests shall be conducted in every Pile and no Extra shall be paid on this account. On ascertaining the Hard Strata through SPT, further Chiselling shall be done for Socketing. The Number of Drops of a given Chisel Falling at a constant fall for a specific depth of penetration shall be noted and these Chiselling Criteria (in terms of number of drops) shall be used to ascertain Hard Strata in the surrounding bores. The Contractor shall submit the Design Calculation for Pile Load Capacity to the Employer on the basis of the Results of Initial Load Test on Piles. The Test Pile shall be installed as directed by the Employer.

Metal Casings with thickness not less than 5mm shall be used to support the unstable sides from the top of the Borehole to the Soft Rock Level.

Minimum Length of the Embedment: A minimum depth of embedment of 9m (including Socket Length) in Soil shall be maintained where the Pile cannot be driven any further. However, the Termination Level of the Pile shall be as per Specific Instructions of the Employer or his approved Representative. In the event of presence of Rock or very Hard Strata at a shallow depth, the Contractor shall be advised by the Employer regarding the Termination Level and the same shall be in conformity with the Codal Provisions.

Pile Diameters: Piles of minimum 1000mm dia or above shall be used for the Flyovers.

i. **Boring**
Boring Equipment and Accessories shall generally conform to IS: 2911 (Part I / Section – 2). Boring may be done by either Rotary or Percussion Equipment. In case of Unstable Soils, the Boring Tools used shall be such that Suction Efforts are minimised. Stabilization of the Sides of the Boreholes shall be done by the use of Bentonite Slurry or Casing. The Size of the Cutting Tool shall not be less than the Diameter of the Pile by more than 75 mm.

ii. **Drilling Mud**
The Drilling Mud shall be used at least from the Level of Subsoil Water or from the Level of Bottom of Guide Casing depending upon the Site Conditions and the Hole shall then be always kept almost full with the suspension, which shall preferably be kept in motion. The Density and Composition of the Suspension shall be such that to suit the Requirements of the Ground Condition and to maintain the Fine Materials from the Boring in Suspension. A 5% Bentonite Suspension would be generally suitable and its quality shall conform to the Specification given in Appendix A of IS: 2911 (Part I / Section 2).

iii. **Cleaning of Borehole Bottom**
The Bottom of the Hole shall be cleaned very carefully before Concreting Work is taken up. The Cleaning of the Hole shall be ensured by careful operation either by Flushing with the Fresh Drilling Mud through the bottom of the hole or by Air Lifting Process. To lift the Spoil at Founding Level before Concreting, Borehole shall be agitated by jetting with Fresh Drilling Mud with relatively higher pressure than that used during Boring or Air through Tremie Pipe. While boring by use of Drilling Mud, the Specific Gravity of the Mud Suspension in the vicinity of the bottom of Borehole shall be determined at Suitable Interval and Record. Consistency of the Drilling Mud Suspension shall be controlled throughout the Boring and during Concreting Operation, in order to keep the Hole stabilised as well as to avoid Settlement of the Mud.

d. **Founding Level for Piers / Abutments**
The Technical Proposal / GAD shall indicate Founding Level at each Pier / Abutment Location. The Turn Key Lump Sum offer shall include for possibility of Cost of Variation if any between the Actual Founding Level and the Founding Level considered for the Purpose of Bidding. No Extra Payment shall be made in this regard after Finalisation of the Turn Key Lump Sum Contract Price.

e. **Ramp / Retaining Walls**

The Solid Ramp Portion of the Flyovers shall be constructed with Reinforced Earth Retaining Structure or RC Retaining Wall designed aesthetically. The Abutments and Returns shall be designed for Live Load Surcharge equivalent to Earth Fill of 1.2m height respectively. The Minimum Density of Filling for Calculations of Surcharge Pressure shall be 2 t / cum. The Surcharge Effect shall be considered for the Purpose of Evaluating Earth Pressure only and not for Vertical Loads.

f. **Pile Foundation**

i. Only Bored Cast – in – Situ Piles shall be accepted.

ii. The Pile Foundations shall be designed as per the Requirements of IS: 2911 (Part I / Section 2) (Latest Edition).

iii. The Contractor shall carry out the Initial Pile Load Test at his own expense. The Design Capacity assumed for the Piles shall be verified by the Initial Load Testing of Test Piles in non working areas, in the vicinity of the Flyovers Site. These Piles shall be tested for 2.5 times the Design Load. Additional Two Piles for each diameter, which are actually going to be used for Piers and Abutments, shall be tested for 1.5 times the Design Load. Minimum Number of both these Tests to be carried out for each Diameter of Pile shall be two (2) each. The Contractor shall carry out the Pile Load Tests as per the Amendments to Existing Methodology of Pile Load Testing by the Task Force for Quality Assurance in Public Construction dated 22 – 10 – 2011 and IS: 2911 (Part 4).

iv. Annular Piles filled or unfilled shall not be accepted.

v. Design with Single Row of Piles shall not be accepted.

vi. Design shall ensure that no Pile is subjected to Tension.

vii. Concreting shall be done, by Tremie Method after ensuring proper Tip Zone Cleaning by Flushing only.

viii. The Top of Concrete in Pile shall be brought above the cut off level by minimum 750mm to permit removal of all Laitance and Weak Concrete before Pile Cap is laid.

g. Open Foundation

Open Foundation may be provided where the foundations can be lied in a stratum which is in erodible and where the strata is hard at shorter depth.

Excavation should be done in such a way that surrounding soil can stand by itself by suitable sloping the sides. When the excavation has to be deep or when the side slopes are not stable, suitable shoring may be provided from top using timber planks, walling piece and struts.

2.8.8 Substructure

a. **Dimensions**

i. Dimension of any Element of Sub Structure shall not be less than 300mm.

ii. All RCC Piers shall be of Solid Type.

iii. The Height of Pedestals on Pier Cap supporting Bearings shall not be more than 500mm.

b. **Protection to Pier**

For the Piers located in the Crossing of Low Level Roads, Protective Island of a minimum height of 1.0m and having a Clear Distance of 250mm from the Face of Pier shall be provided. The Gap between the Pier and the Island Wall shall be filled with Sand. Suitably Designed and Aesthetically Pleasing Fencing made out of Steel Members and painted with Protective Paint shall be fitted on the Top of Wall of the Island.

c. **Layout and Design**

i. All Bearings shall preferably be supported directly on Pier Stem. Bearings resting on Overhangs are acceptable provided the Differential Deflection of Pier Cap is accounted for in the Transverse Analysis

of Superstructure.

ii. Dead Man Anchors or Friction Slabs shall not be accepted behind Abutment for relieving Moments.

iii. Scope for Accessibility for Inspection of Bearings and Arrangement for Lifting of the Superstructure for Future Replacement of Bearings shall be provided for in the Design of Sub Structure and Superstructure. The Positions of Flat Jacks shall be distinctly marked on the Drawing and the Structure.

iv. Tall Piers shall be checked for Deflection under Horizontal and Eccentric Forces. Pier, Bearings and Expansion Joints shall be suitably designed.

2.8.9 Superstructure

a. **Deck Slab**

Deck Slab Thickness shall not be less then 200mm.

b. **Box Girders**

i. For Pre Stressed Concrete Structure where Cables pass through Webs, minimum Web Thickness shall be greater of 150mm + outer dia of Duct or 250mm, whichever is greater.

ii. The Cross Diaphragms shall be minimum, one number at each Support and at ends of Cantilever, if any. In addition to Abrupt Change in Soffit Geometry, Stiffening Frame or Diaphragm shall be provided to cater to the Forces arising out of Change in Direction.

iii. Minimum Thickness of Diaphragms at Supports shall be 500mm and those of other Locations shall be 300mm.

c. **RCC Box**

The following Method of Analyses and Design of Box Girder are acceptable.

i. Calculate the Main Girder Moments, Shear Forces and Tensional Moments as for a Single Beam for all Loading Conditions.

ii. Also add to above, the Forces due to the Restraint of Warping Torsion at the Ends.

iii. In addition, calculate the Bending Moments in the Roadway Slab considering the Slab, the Web and Soffit Slab as a Closed Frame.

iv. Reinforcement in the Slabs and Webs due to the Transverse Moments must be provided in addition to the Steel, which is required for Shear or Torsion in the Box as a Main Girder.

v. Distortion of Box Girder due to Transverse Moment can be neglected if a minimum number of Diaphragms are provided.

vi. In the absence of Rigorous Analysis (A) for the Tensional Moment (B) for Forces due to Restraints of Warping Torsion at ends, the Design Live Load Moments and Shear Force in the Longitudinal Direction shall be increased by 20% and Transverse Reinforcement Steel be increased by 5%.

d. Prestressed Concrete Box

i. Minimum Un tensioned Reinforcement as per Clause 15 of IRC 18 (Latest Edition). The Spacing of the Bars shall not exceed 200 mm c / c. The minimum Diameter of Bars to be used is 10mm.

ii. Method of Analysis and Design of Box Girder shall be the same as detailed for RCC Box Girder.

iii. No Tension under Full Permanent Design Load.

e. **Prestressing Steel**

i. The Prestressing Cables to be used shall be made using Low Relaxation HT Strands of size 12.7mm / 15.2mm conforming to 1S: 14268.

ii. All Prestressed Members shall have Spare Cables laid to the Profiles approved by the Employer. The number of Spare Cables shall be at least 5% of the Cables required as per the Design, subject to a minimum of one Cable per Girder / Web. These Cables shall be permitted to be removed fully or partly after the Final Stage of Pre Stressing, if they are not required and Holes grouted.

iii. The Maximum Permissible Jacking Force shall not exceed 90% of 0.1 % Proof Stress. 0.1 % Proof Stress shall be taken as 85% of Minimum Ultimate Tensile Strength (UTS).

iv. Arrangement for External Pre Stressing shall be got approved from the Employer.

f. **Prestressed Concrete Girder and Slab**

Concrete Girder and Slab type Superstructure shall satisfy the following Stipulation.

i. Minimum Thickness of Slab shall be 200mm.
ii. Minimum Thickness of Web shall be 250mm.
iii. Where Prestressing Cables pass through Webs, the Thickness shall be same as that stipulated for Webs of Box Girder.
iv. For Prestressed Girders, the Criteria stipulated in **2.8.9** will be applicable.

g. **Precast Girders**

i. For Ease and Speed of Construction, it is recommended that Precast Concrete Superstructure may be adopted. While designing such Elements / Structure, Aspects of Durability and Minimum Maintenance shall be kept in view. Criteria of Minimum Dimensions as per **2.8.9** shall be applicable.

ii. Precast Panel Slab Deck / Girders and Cast – in – Situ Slab Construction shall be designed as Composite Construction.

iii. Cross Prestressing in Superstructure shall not be allowed in general. However, the Nominal Prestress provided to the extent of keeping various Girders together will be allowed.

iv. In Pre Cast Construction, the Performance of Joints is especially critical for the Integrity of a Structural System. The Geometric Configuration of a Joint, in addition to the Selection of an Appropriate Interface Material contributes to the proper Short Term and Long Term Performance of the Structure. The Design of Joints shall allow for Movements due to Shrinkage, Thermal Effects and Possible Differential Settlements.

v. Proper Lifting Arrangements shall be arranged by the Contractor for handling the Pre Cast Unit. The Components shall be designed for Lifting and Erection of Loads and Stresses. Lifting and Handling Positions shall be clearly defined particularly at Critical Locations. Indelible Identity, Location and Orientation Marks shall be put on all Segments as and when necessary.

h. **Precast Segment**

In order to achieve Better Speed of Construction, Pre Cast Segmental type Construction may be adopted for Superstructure. Following Aspects shall be taken into account while Designing and Constructing using the following Techniques.

i. Requirements regarding Minimum Dimensions, Reinforcements, Prestress, etc. shall be as per **2.8.9**.
ii. For Construction with Continuous Spans, the Portion over Piers, the Key Segments and End Segments at Expansion Joints may be Cast – in – Situ. All other Segments shall be Pre Cast. For Simply Supported Spans, all the Segments shall preferably be Pre Cast.

iii. All the Segments shall be match – cast.

iv. The Shear Keys at the Face of Segments shall be as under.
- On each Web, Single Key or Multiple Keys shall be provided. These keys shall be designed to transmit Shear Forces.
- On the Top and Bottom Slabs, Keys shall be provided to maintain Alignment and Level.

v. Formwork shall be Robust and the Foundations of the Casting and Stacking Yard shall be designed to safely support all Applied Loads without Undesired Deformations or Settlements.

vi. In order to achieve Smooth Profile of Pre Stressing Cables and to prevent Entry of Cement Slurry at the Joints of Matching Segments, PVC Pipe shall be inserted through the Cable Duct of both the Segments (i.e. Matching Segment and Segment being cast) at the time of concreting.

vii. The Work shall be executed by specially Experienced Team of Pre Stressing Professionals.

viii. Bond Breaking Agents shall be used while casting the Segments so that the Segments can be easily separated after casting. Scheme for Pre Casting of Segments shall be approved by the Employer.

ix. The Joints between Adjacent Segments shall be treated with appropriate Epoxy Formulation to facilitate Erection and to fill Cavities, if any. While applying Epoxy, care shall be taken to see that the Epoxy does not block the Openings of the Cable Ducts. Epoxy shall be applied on the Interface of both the Segments and the Joint subject to a minimum Pressure of 2.0 Kg / Sqm for a period of 24 hours till the Epoxy sets. This may be achieved by Temporary Pre Stress or any other Means. Permanent Cables shall then be introduced in the Ducts and after Pre Stressing the required No. of Cables in the Specified Sequence, the Temporary Pre Stress may be released.

x. The Method of Erection of Segments shall be such that the Desired Geometric Profile of the Loop Deck is obtained.

xi. The Segments shall be checked for Stresses during Handling and Erection and Necessary Calculations shall be submitted for the Employer's Approval.

xii. External Pre Stressing Cable System is allowed for Segmental Pre Cast Superstructure.

xiii. Calculations for Segment Casting Dimensions shall be submitted for the Employer's Approval taking into account the Effect of Creep and Shrinkage.

xiv. Reference may be made to the Document "Guides to Good Practice Recommendations for Segmental Construction in Prestressed Concrete" published by FIP and 'State of the Art Report on Materials and Systems for External Pre stressing".

NOTE: The Tenderer may submit his Alternative with Composite Structure. The Composite Section shall be limited to Superstructure only with Girders in Steel and RCC Deck Slab.

2.8.10 Bearings below Superstructure

Bearings under Superstructure shall be within the External Line of the Pier / Abutment. The Bearings shall be provided below the Diaphragm at Suitable Locations.

a. The Types of Bearings generally allowed are as follows.

Span	**Type of bearing**
For Effective Spans up to 18m	Elastomeric Bearings
For Effective Spans more than 18m	Spherical/POT cum PTFE / POT

b. The Bearings shall be easily accessible for Inspection / Maintenance.

c. Scope for Lifting the Superstructure for future replacement of Bearings shall be provided in the Design of

Bearing. The Scheme of Lifting shall be indicated in the Drawing to be submitted along with the Technical Bid.

d. Inspection of Bearings by the Director General of Supplies and Disposal (DGSD) during manufacture is essential. The Contractor shall have to produce Necessary Certificate and Inspection Marks from the DGSD at his own Cost.

e. The Bearings shall conform to the Requirements of the MoRT&H Specifications.
f. The Dimensions of the Top Plate of the Bearing shall be such that the Contact Surface of the Superstructure projects beyond the Edge of Bearing Plate by a minimum distance of 50mm at any Location.

2.8.11 Expansion Joint

Elastomeric Strip Seal Type Expansion Joint conforming to Clause 2607 of MoRT&H Specifications shall only be allowed. Calculations for the Adequacy of the Expansion Extent for which the Joint is selected by the Tenderer shall be submitted in the Technical Bid along with Name of Manufacturer and their Technical Details. During Installation of these Joints, Manufacturer's Engineer shall be required to supervise the same including Thermal Pre Setting, if required.

2.8.12 Crash Barrier

Concrete Crash Barrier shall conform to Clause 809 of MoRT&H Specifications. The Tenderer may propose Alternate Type of Crash Barrier in the Technical Bid. It will be necessary to provide a 50mm dia MS Tube Hand Rail 300mm above the Crash Barrier and supported at Suitable Intervals. No Welding shall be done for Connections. Crash Barriers shall be provided with Employer's Emblem as per the Approval of the Employer.

2.8.13 Drainage

Drainage of Storm Water collected on the Rotary Flyovers/ROB is essentially based on
IRC: SP: 42 "Guidelines on Road Drainage"
IRC: SP: 50 "Guidelines on Urban Drainage"

The Drainage Spouts shall conform to Clause 2705 of MoRT&H Specifications. The Tenderer shall indicate the Drainage Spouts and its Disposal to natural Storm Water Drain in the Drawings submitted with the Technical Bid.

The Drainage Spouts shall be connected to a Cast Iron Runner Pipe of diameter not less than 150mm and taken down by Down Take Pipes of suitable diameter through the Pier or at Approved Locations. These Pipes shall be connected to Longitudinal Drains below Surface and the Water finally being disposed off into natural Storm Water Drain using appropriately designed RCC Box Culverts for Crossings.

At Ground Level, Catch Water Drain with GI Gratings at Top shall be provided at each end of the Flyovers. Drainage of Water collected at the Deck Level shall be effectively conveyed to Tertiary Drains at Ground Level through Appropriate Box Culverts across Surface Level Roads. The Drains shall be connected to the nearest natural Storm Water Drain. The Turn Key Lump Sum Cost shall include for all these Items.

The entire System including all Arrangements / Details shall be included in the Cost.

2.8.14 Wearing Coat

A Bituminous Wearing Coat of Uniform Thickness shall be provided for Smooth Riding Surface and shall conform to Clause 2702.1 of MoRT&H Standard Specifications for Road and Bridge Works (Latest Edition). The Cross Sections indicated in the Drawing no **NEZPL/DWG/PRJ/204-1 TO 6** for Rotary and ROB at LC 136A shall be strictly adhered to.

2.8.15 Approach Slab

The Approach Slab shall conform to Clause 2704 of MoRT&H Standard Specifications for Road and Bridge Works (Latest Edition).

2.8.16 Electrical Works

The Tenderer shall include the Cost of Lighting above and below the Flyovers in his Turn Key Lump Sum Tender and shall carry out all the Electrical Works as per relevant Codal Provision. The Tenderer shall indicate the proposed Lighting Arrangements as per relevant IS Codes and the existing Street Lights in the Drawings submitted with the Technical Bid. The Lumination shall be average of 40 lux throughout above and below the Flyovers.

2.8.17 Integrity Test

Low Strain Integrity Test shall be carried out for all the Piles in conformation to ASTM D 5882 from an Empanelled Consultant in the Ministry of Shipping, Road, Transport & Highways. The Tenderer shall include the Cost of Conducting this Test in his Turn Key Lump Sum Tender.

2.8.18 Painting

Painting with Approved Colour, Shade, Make and Type shall be provided for various Elements as follows.

i.	Steel Box Girder / Steel I girder	With two coats of epoxy paint conforming to RDSO spec M&C/PCN/123-11
ii.	Viaducts and RE Panels / Retaining Wall	Anti Carbonate Painting as per Specifications.
iii.	Kerbs for Medians, Footpath, etc. and Guard Railings, Grills and other MS Items, wherever required.	Two Coats of approved Enamel Paint over Two Coats of Zinc Phosphate Grey Primer.
iv.	MS Hand Rails over Crash Barrier	Two Coats of Epoxy Paint over a Compatible Primer after Cleaning the Surface with Sand Blasting.

2.9 Load Test

a. Before commencement of work contractor at his own risk shall perform the vertical and horizontal test as initial load test on test pile and on routine piles for elevated rotary and ROB as per relevant IRC code. Apart from the above test in case a Structure or a Component of Structures proposed by the Contractor in the opinion of the Employer is of Unusual Nature, then the Employer shall have the Right to call upon the Contractor to carry out Model Testing and / or Load Testing of the Structure or Component to prove its Suitability. The Cost of such Test shall be borne equally by the Contractor and the Employer if the Test Results are Satisfactory. In case the Test Results are not satisfactory, the Cost of Testing shall be entirely borne by the Contractor.

b. If required by the Employer, the Contractor shall have to carry out a Load Test on anyone Unit of the Bridge Structure for the Design Static Loads or their equivalent and in a manner as may be decided by the Employer.

c. The Employer may also instruct that a Load Test shall be made on any part of the Bridge Structure if in his opinion such a Test be deemed necessary for anyone or more of the Reasons specified below.
   i. The Work Test Cubes failing to attain the Specified Strength.
   ii. Shuttering being prematurely removed.
   iii. Concrete being improperly cured.
   iv. Any other Circumstance(s) attributable to the Negligence on the part of the Contractor which in the Opinion of the Employer results in the Structure or part thereof being of less than the expected Strength.
   v. Any Reasons in case of Doubtful Quality or Soundness of Structure.

d. If the Load Test is to be made
   i. For anyone or more Reasons mentioned in (b) above, the Cost of the same shall be Reimbursable to the Contractor at the rate tendered by him, provided the Test Results thereof are found to be Satisfactory.
   ii. Wholly or partly for the Reasons given in (c) above, the Test shall be carried out by the Contractor, at no extra Cost to the Employer.

e. In the Event of Load Testing being ordered by the Employer, the Contractor shall
   i. Prepare well in time all Necessary Calculations and Details of Arrangements for such Load Testing, e.g. the Magnitude of the Test Load, Mode and Method of Carrying out the Test, the Application of Loads,

Duration of Keeping the Load, the Equipments to be provided and Observations to be made during and after Placing the Loads in Position, etc.

ii. Make all Necessary Arrangements for Observations, Centering, Equipments, etc. that may be needed for Measuring the Settlement, Deflections, etc. required for the Test, to the entire Satisfaction of the Employer and

iii. Provide Labour and make all Observations during the Test.

f. After the Test, the Contractor shall submit a Report on the Results of the Tests. The Employer shall then communicate as to whether the Test has been satisfactory or not. Any Further Tests or Reconstruction or Strengthening as may be necessary shall be decided.

g. Any Defect noticed in the Structure or any Damage done to the Bridge, at the Time of Testing, which affects or is likely to affect the Strength of the Bridge, shall be rectified by the Contractor at his own Cost by Remedial Measures or Replacement as approved by the Employer.

h. When the Tests are declared by the Employer as having been completed, the Contractor shall remove all Loading, which might still be on the Bridge as well as on the surroundings.

i. Only Design Load is to be superimposed for Prestressed Concrete Superstructure. IRC: SP: 37 shall be followed for Load Testing. Necessary Correction for Variation in Deflection due to Temperature Variation throughout the day shall be applied.

2.10 Slip Roads, other Surface Level Roads , Culverts and Junction Improvements

The Work of Slip Roads, other Roads at Grade and Junction Improvements to be carried out under this Contract is indicated in concept and alignment drawing no NEZPL/DWG/PRJ/204-3 at the locations of all the rotary approaches and from new terminal railway station to old Madras road till NH-4 Junction and shall include the following.

a. Construction of new Slip Roads, Widening and Resurfacing of Existing Roads; Dismantling of Existing Structures coming on the Carriageway such as Buildings, Compound, Drains, Footpaths, Kerbs, Medians, Parapet Walls; Construction/widening of Culverts / Box culverts ; etc. The following Standards and Specifications shall be adopted for the Slip / Surface Level Roads.

- Slip Roads beyond the Lengths of the approaches to Elevated rotary Ramps are to be merged with Existing Roads through a Taper / Transition of 1 in 15.
- Slip Roads, Surface Level Roads in the Battery Limits shall comprise of 300mm thick Sub Grade (of CBR > 10), 200mm thick Sub Base (GSB), 250mm thick Base (WMM), 100mm thick DBM and 40mm thick BC.

b. Construction of Footpath along with Road Side Drain with collective drain and Utility Duct covered with 100mm thick RC Precast Slab and providing Heavy Duty Cobble Stone 60mm thick Interlock Pavers of Approved Size, Shape and Colour with a minimum Compressive Strength of 281 kg / Sqm in the Additional Width of Footpath i.e. leaving the Width of Road Side Drain and Utility Duct ; Medians; Kerbs, Railing on Footpath including Construction of Compound, Storm Water Drains, Drain Cover Slabs, Traffic Signages, Overhead Gantry, Road Marking such as Lane Marking, Pedestrian Marking, Direction Marking, STOP and STOP Lines, etc. as per the Specifications given MoRT&H and Kerb Painting as per the Specifications mentioned in this Tender Document.

c. The Construction of Medians, Kerbs and Footpath shall conform to Clause 407, 408 and 409 of the MoRT&H Specifications for Road and Bridge Works (Latest Edition) and shall be shown in the Drawings submitted with the Technical Bid.

d. Dismantling of Existing Road Over Bridge at IOC Junction with down ramp loop, etc and reconstruction with Elevated Rotary with approaches as per the structural design mentioned above section 2.8

e. **Guard Rails shall be provided to protect the Piers below the Rotary ramps on all approach sides as per Clause 808 of MoRT&H Specifications for Road and Bridges (Latest Edition).**

2.12 Submission of Elevated Rotary/ROB design Reports for Railway approval

After award of work, Successful Tenderer shall submit the following design reports for railway Approval

1. Design basis report of the bridge stating the salient features of bridge, i.e span, skew angle span arrangements, longitudinal eccentrics, depth of girders, type of superstructure STEEL, R.C.C., PSC, composite, type of bearings arrangement with sketch showing fixed/free ends, curvature if any and the details of parameters codes, load combinations cases, wind, seismic zone etc. For drawings of non-standard span of Railways must duly proof checked by IIT/IISc, NIT/approved consultants for this purpose before submitting the detail design.

2. Soil report of the railway bridge site with bore hole at each railway pier and abutment location and also shown on sketch showing the bore holes locations w.r.t to pier/abutment positions. The recommendations of the soil consultant for the open foundation/pile foundation if applicable clearly stating the pile length with safe loads for two three alternates.

3. The feasibility of the structure or components must be checked in all respects by the tenderer before submitting the design to Railway/BBMP office and signed by the authorized signatories of Tenderer.

4. The drawing must be submitted in preferably A-I size only in prescribed/standard format.

5. The design/drawing of the test pile is to be submitted if applicable for the approval as per the codal provisions duly proof checked by IITs lNIT/approved consultants.

6. The software/staad files hard copy as well as soft copy must be submitted with the design note used in design for help in checking the design.

7. PSC Superstructure has to be as per IRC-112, Composite Superstructure has to as per IRC-24

8. Stress summary should be prepared for each component of the bridge i.e. pile or open foundation as applicable, pile cap/foundation slab and beam, pier, pie cap, stating the actual stresses vs permissible stresses or steel provided vs steel required.

9. A certificate from the proof checking agency on successful Tenderer letter head stating that the design and drawing of the bridge has been checked by me and found in order as per the latest IRC codal provisions.

2.13 Safety precautions and measures to be observed during execution of Elevated Rotary/ROB works in Railway and Adjoining areas

The works required to be done under traffic block protection, are to be carried out only in the presence of Railway Engineering officials. The Railways supervisor has to certify safe conditions for passage of trains before resumption of traffic. Following important activities of works shall be carried out under supervision of Railways nominated Supervisor

a) Excavation at foundation/Ground level near to Railway track.
b) Concrete casting and/or masonry very close to Railway track.
c) Erection of temporary structures near to running lines.
d) Casting of structures like girder/slab over Railway track.
e) Stage-Pre-stressing of girders when placed across Railway tracks properly supported.
f) Launching of precast/pre-assembled girders across Railway tracks.
g) Any work of lifting, side shifting and slewing of girders over the Railway track.
h) Dismantling of temporary structures, shutters, scaffolding etc. adjacent to and above the Railway track.
i) For carrying out activities of casting, erection, launching, handling and dismantling as listed above, the Contractor's Engineering shall furnish the Construction Programme in advance to Railway Supervisor Engineer. No such work should be taken up in absence of the Supervising Railway Engineer. For the activities which are to be done in presence of the Railway Engineer, prior intimation shall be given in writing and acknowledgement

obtained from Railway's representative. Such activities of work shall not be carried without the presence of Railway Engineer.

2.14 Resurfacing / Reconstruction of Surface Level Roads and Providing New Drainage System

The Tenderer shall include the Cost of Resurfacing / Overlays of all Roads and New Drainage System in the Site handed over to him. The Tenderer shall include in his Cost the Cost of Resurfacing / Overlays of all Roads in the Battery Limit and Construction / Strengthening / Maintenance of Roads and Junction Treatment for smooth flow of Diverted Traffic during Construction. Further, it may be noted that the Resurfacing of Road shall be carried out periodically as per the Instruction of the Employer during Construction Period and also finally before handing over the Work. The Turn Key Lump Sum Amount quoted is deemed to include Repetitive Asphalting.

2.15 Traffic Signs, Markings and other Road Appurtenances

Traffic Signs, Markings and other Road Appurtenances shall conform to Clause 800 of the MoRT&H Specifications for Road and Bridges (Latest Edition) and shall be shown in the Drawings submitted with the Technical Bid. Road Markings shall conform to IRC: 35 (Latest Revision) and Road Signs shall conform to IRC: 67 (Latest Revision). The Tenderer shall submit the Detailed Drawings of the Signages required as per the relevant IRC Specifications. Overhead Gantry by indicating Destinations as per the Approval of the Employer shall be provided at the Approved Location. Signages shall be provided with Retro Reflective, Micro Prismatic Reflectionised Stickers. Advanced Direction Boards with similar Specifications as above shall be provided at Locations mandated by IRC and as directed by the Employer.

2.16 Drainage System

The Contractor shall carry out Hydraulic Study in the entire Catchment Area, which is having influence on the Battery Limit of the Project, in order to assess the Quantity of Runoff to be drained off from the Battery Limit. For this purpose, the Contractor shall map the Storm Water Drainage System, which passes through the Battery Limit. He shall calculate total Quantity of Runoff, which precipitates on the Battery Limit Area and enters the Battery Limit Area. The Contractor shall work out a Comprehensive Drainage System for Disposal of Runoff collected in the Elevated Rotary/ROB, on Surface Level Road by Gravity Flow only and the Drain shall be connected to the nearest Natural Storm Water Drain and as per the Approval of the Employer.
All Drainage System shall conform to Clause 309 of MoRT&H Specifications for Road and Bridges (Latest Edition).

However, the Levels and Dimension Details for Drainage Arrangement shown in the Drawings are only indicative. The Contractor shall carry out the required Hydraulic Study and work out the Levels and Dimension Details for Drainage Arrangement based on the Hydraulic Study and get the Drawing approved by the Employer before Execution.

The Tenderer shall indicate a Comprehensive Drainage Arrangement System in the Drawings to be submitted with the Technical Bid.

The Lump Sum Cost quoted by the Tenderer shall include all the above Items. During the Construction, the Water, which is met with, shall be pumped into the Roadside Drains. At no point it shall be pumped into BWSSB Sewer / Sanitary Lines.

2.17 Corridor Improvement Works at Grade

a. The Stretches of Corridor to be improved under this Work are as indicated below.

- **Kammanahalli side after construction of flyover**
  From ch o to 255 for service road at grade
- **Banasavadi side after construction of flyover**
  From ch o to 250 service road at grade
- **Mukunda theater side after construction of flyover**
  From ch o to 1496m battery limit for service road at grade
- **Loop road at Mukunda theater at Ch 50 on LHS**
  loop road ch: 0 to 125 Pipe drain on RHS

and Ch: 125 to 150 Pipe drain on RHS

- **New Railway station to Old madras road direction**
  1000m length (From ch 175 to 2600) for main road & service road at grade
- **Additional 5.5m wide new road at Grade parallel to down ramp to Railway station Ch 150 to 550**

It shall also include all the Cross Roads up to 10m length from the Corridor, all the Junctions and Service Roads. The General Site Particulars are shown in the Topographical Map. Refer Tender Drawings from **Drawing no NEZPL/DWG/PRJ/204-2 /3/4-1 TO 6**

b. The Quantities shall be executed in the Locations as per the Instructions of the Employer / his Representatives.

c. The Contractor shall prepare Inventory of existing Materials and Proposal for Disposal and Stacking of the Materials and the same shall be approved by Employer / his Representatives.

d. The Items proposed for Improvements as a part of this Corridor Improvement Works are
   - Carriageway
   - Paved Pedestrian Crossing
   - Median
   - Footpath
   - Shoulder Drain
   - Road Side Drain
   - Illumination

2.17.1 Carriageway Improvement Works

The Works to be carried out under this Turn Key, Lump Sum, Fixed Price, and No Variation Contract shall include

j. Improvements to Carriageway for the Stretch mentioned above and shall be as per the Instructions of the Employer / his representatives. It is inclusive of dismantling of existing Black Topped Surface, and Disposing of Disused Materials and re construct the pavement crust with subgrade , GSB,WMM and Bituminous layers as per MORT&H Specifications as specified above

ii. Providing and applying Tack Coat on the Prepared Black Topped Surfaces at 2.5 kg per 10 Sqm as per MoRT&H Specifications.

iii. Providing and fixing Pre Cast Solid Concrete Kerb Stones of Size 600mm X 300mm X 150mm made out of CC M15 and finished with CM 1:3 Plastering and Finishing, Cutting, etc.

v. **Road Marking with Hot Applied Thermo Plastic Compound with Reflectorising Glass Beads on Bituminous Surface along Edge Line near Footpath and Median, Centre Broken Line and Zebra Crossing near Junctions as per the Instructions of the Employer / his Representatives:** Providing and laying of Hot Applied Thermoplastic Compound 2.5mm thick including Reflectorising Glass Beads at 250gms per Sqm area, whereas Thickness of 2.5mm is exclusive of Surface Applied Glass Beads as per IRC: 35 (Latest Edition). The Finished Surface shall be level, uniform and free from Streaks and Holes and shall be completed as per MoRT&H Specifications.

vi. Providing and fixing of Road Stud of Size 100 X 100mm, die cast in Aluminium, Resistant to Corrosive Effect of Salt and Grit, fitted with Lens Reflectors, installed in Concrete or Asphaltic surface by Drilling Hole 30mm upto a Depth of 60mm and bedded in a suitable Bituminous Grout or Epoxy Mortar, all as per Specifications of BS: 873, Part 4 along Edge Line near Footpath and Median, Centre Broken Line and Zebra Crossing near Junctions as per the Instructions of the Employer / his Representatives.

The Contractor shall carry out the Carriageway Improvement works at grade covering minimum length Of about 2.5 Km at Grade.

Paved Pedestrian Crossing

The Works of providing Paved Pedestrian Crossing of 3m wide to be carried out under this Turn Key, Lump Sum, Fixed Price, No Variation Contract shall include

i. Scarifying Top Bituminous Surface or Surface Dressing or Premix Carpet including Picking up Scarified Materials, Stacking of old Serviceable Materials and complete as per MoRT&H Specifications.

ii. Providing and applying Tack Coat on the Prepared Black Topped Surfaces at 2.5 kg per 10 Sqm as per MoRT&H Specifications.

iii. Providing and laying Bituminous Concrete of 30 – 45mm compacted thickness with 40 – 60 TPH Batch Type Hot Mix Plant using Crushed Aggregates of Grading II, pre mixed with Bituminous Binder at 5.4 to 5.6% by weight of total Mix and Filler using Bitumen 60 / 70, laying with a Hydrostatic Paver Finisher with Sensor Control to the required Grade Level and Alignment, rolling with Smooth Wheeled, Vibratory and Tandem Rollers to achieve the desired compaction as per MoRT&H Specifications.

iv. Providing and laying Heavy Duty Cobble Stones 75mm thick Interlock Pavers, using Cement and Course Sand for Manufacture of Blocks of Approved Size, Shape and Colour with a minimum Compressive Strength of 281 kg per Sqm over 50mm thick Sand Bed and compacting with Plate Vibrator having 3 Tons Compaction Force thereby forcing Part of Sand underneath to come up in between joints, final compaction of Paver Surface Joints into its final level and complete as per the Instructions of the Employer / his Representatives.

v. Providing and fixing Precast RCC Slab of 100mm thick for Side Wall in Cement Concrete 1:1.5:3 using Graded Granite Jelly 20mm and Downsize with Steel Reinforcement, including Form Work, Curing and Concrete Finished Surfaces on both sides, etc. and complete as per the Instructions of Employer / his Representatives.

2.17.2 Pipe Duct

The Works to be carried out under this Turn Key, Lump Sum, Fixed Price, No Variation Contract shall include

i. This Work includes required Excavation, providing RCC pipe duct across the road at Kammanahalli, Maruthi sevanagara side, Railway station road for a total length of 50m

ii. Excavation, providing and laying of Plain Cement Concrete of minimum 100mm thick, Providing and laying of Class NP3 Hume Pipe of 300mm diameter at 2.5% Slope

iii. Packing the sides and above the Hume Pipe with Controlled Earth as per the Instructions of the Employer / his Representatives.

The Contractor shall provide Shoulder Drain on either side of the Carriageway at an interval of not less than 15m c/c. Further, the Contractor shall carry out the required Hydraulic Study and work out the Levels and Dimension Details for Drainage Arrangement based on the Hydraulic Study and get the Drawing approved by the Employer before Execution.

2.17.3 Road Side Drain

The main objective of this Work is to facilitate Free Water Flow in the Road Side Drain collected from ROW and from adjoining Properties. The Works to be carried out under this Turn Key, Lump Sum, Fixed Price, No Variation Contract shall involve two types of Works and they are

- Replacement of BS Slab Drain with new RCC Drain covered with concrete Slab,
- Construction of new RCC Drain covered with new RC Precast Slab.

2.17.4.1 Construction of new RCC Drain covered with new RC Precast Slab

This involves Construction of RCC Drain of minimum Dimension 1m Width X 1.0m Depth along 1000m length of road with RC Precast Slab of minimum 100mm thick.

The above Work involves the following Items.

- ❖ Earthwork Excavation for Drain, levelling of Excavated Surface with the sides neatly dressed.
- ❖ Disposal of the Disused Materials.
- ❖ Providing and laying minimum 100mm thick PCC M15 with OPC Cement @ 240 kg / cum, 40mm Downsize Graded Granite Metal Coarse Aggregate @ 0.84 cum / cum and Fine Aggregates @ 0.56 cum / cum in Open Foundation and complete as per MoRT&H Specifications.
- ❖ Providing Open Box Type RC Wall of minimum thickness 200mm with Design Mix M20 with minimum OPC Cement @ 320 kg / cum, with 20mm Downsize Graded Granite Metal Coarse Aggregates @ 0.69 cum / cum and Fine Aggregates @ 0.46 cum / cum with Superplastisiser @ 3 litres for each cum of Concrete

conforming to IS: 9103 including all necessary Dewatering, Centering, Shuttering, etc. as per the Approved Design.

- ❖ Backfilling and Compaction behind the Side Walls with Approved Earth.
- ❖ Providing and fixing of Precast Perforated RC Slab of minimum 100mm thick for Cement Concrete 1:1.5:3 using Graded Granite Jelly 20mm and Downsize with Steel Reinforcement, including Formwork, Lifting, Curing and Concrete Finished Surfaces on both sides, etc. and complete as per the Instructions of the Employer / his Representatives.

Further, the Contractor shall carry out the required Hydraulic Study and work out the Levels and Dimension Details for Drainage Arrangement based on the Hydraulic Study and get the Drawing approved by the Employer before Execution. The Hydraulic study includes planning and construction of Rain water collection system and harvest of the same at Rotary and RoB locations.

2.17.4 Kerb

The Works of providing and fixing Kerb Stones to be carried out under this Turn Key, Lump Sum, Fixed Price, No Variation Contract shall include

- ❖ Providing and fixing Precast Solid Concrete Kerb Stones of Size 600 X 300 X 150mm made out of CC 1:2:4 and finished with CM 1:3 Plastering and finishing, cutting, etc. in the Median and at the edge of Footpath for a length of 6000.00m as per the Instructions of the Employer / his Representatives.
- ❖ Realignment of existing Kerb Stones at the Dislocated Places and fixing with CM 1:3.
- ❖ **Painting of Kerb Stones:** Painting two coats after filling the Surface with Synthetic Enamel Paint in approved shades on new Plastered Concrete Surfaces as per MoRT&H Specifications for the entire Stretch of Corridor.

2.17.5 Footpath

The Works of providing Footpath for minimum Area of 7000.00 Sqm to be carried out under this Turn Key, Lump Sum, Fixed Price, No Variation Contract shall include

- ❖ Providing and fixing Interlocking Cobble Stone Paver
  This Work shall include the following Items.
  - Required Earthwork Excavation.
  - Disposal of Disused Materials.
  - Surface Levelling.
  - Providing and laying Cast – in – Situ RCC Slab of 200mm thick for Side Wall with Design Mix M20 with minimum OPC Cement @ 320 kg / cum, with 20mm Downsize Graded Granite Metal Coarse Aggregates @ 0.69 cum / cum and Fine Aggregates @ 0.46 cum / cum with Superplastisiser @ 3 litres for each cum of Concrete conforming to IS: 9103 including all necessary Dewatering, Centering, Shuttering, etc. and complete as per the Instructions of Employer / his Representatives.
  - Providing and laying minimum 50mm thick Sand Bed.
  - Providing and laying Heavy Duty Cobble Stones 60mm thick Interlock Pavers, using Cement and Coarse Sand for Manufacture of Blocks of Approved Size, Shape and Colour with a minimum Compressive Strength of 281 kg per Sqm over 50mm thick Sand Bed and compacting with Plate Vibrator having 3 Tons Compaction Force thereby forcing Part of Sand underneath to come up in between joints, final compaction of Paver Surface Joints into its final level and complete as per the Instructions of the Employer / his Representatives.
- ❖ Planting of 215 Nos. of Approved Trees on the Footpath along with MS Tree Guard 0.60 metre square, 2.0m high fabricated with MS Angle Iron 30 X 30 X 3mm, MS Iron 25 X 3mm and Steel Wire 3mm dia welded and fabricated as per the Approved Design in two halves bolted together and complete as per the Instructions of the Employer / his Representatives.

2.17.6 Illumination

The Illumination Works to be carried out under this Turn Key, Lump Sum, Fixed Price, No Variation Contract shall include Replacement, Fixing and Laying of Damaged Box Tunnels, LT Cables, Earthing Requirements, Poles, Fixtures and Painting of Poles and complete as per the Instructions of the Employer / his Representatives.

2.17.7 Traffic Signage and Marking

This Work to be carried out under this Turn Key, Lump Sum, Fixed Price, No Variation Contract shall include providing and fixing of Retro Reflectorised Cautionary, Mandatory, Informatory Sign as per IRC: 67 (Latest Edition) made of high intensity grade sheeting, fixed over Aluminium sheeting, 1.5mm thick supported on a Mild Steel Angle Iron Post 75mm X 75mm x 6mm firmly fixed to the ground by means of Approved Designed Foundation with M15 Grade Cement Concrete 45cm X 45cm X 60cm, 60cm below Ground Level as per the Approved Drawing and complete as per MoRT&H Specifications.

The Sign Boards shall include the following.

- 60cm Circular and equilateral triangle of 18 Nos each.: No Parking Board, Speed Limit Board, Compulsory Ahead or Left Turn, Overtaking Prohibited Board, No Stopping Sign Board.
- 90cm Equilateral Triangle of 8Nos each. Pedestrian Crossing Sign Board, No Pedestrian Crossing Sign Board.
- 90ch high Octagon of 8 Nos.: Informatory Sign Board.

2.17.8 Bus Shelter

This Work to be carried out under this Turn Key, Lump Sum, Fixed Price, No Variation Contract shall include providing 1 Nos. of Bus Shelters at the Locations as decided by the Employer / his Representatives and cost of the Bus shelter is deemed to be included in the quoted rate.

2.17.9 Project Cost estimate

The estimate for the project has been arrived based on the concept and alignment plan considering the quantities of all the items as mentioned in the scope of works. The tenderer shall study the concept drawings and scope of the work thoroughly in detail before submission of tender. The successful tenderer shall be responsible to complete the above entire scope of work including preparation of detailed design working drawings and obtaining GAD approval from Railways/ BBMP within the quoted contract amount under no variation. Elevated Rotary is designed with of Steel Box Girder with top open Trapezoidal section per span for a circumferential length of 255m with 4 different spans, of which super structure of 1 x 81.31m, 1 x 68.5m, 1 x 56.0m, & 1 span of 48.0m, and a longest span of 81.31m with varying depth of Girder from 1.5m to 2.5m, and each span with 3 nos of steel box girders. The type of deck slab proposed for ROB at LC No 136A is with I- Girder with composite slab. The approaches to elevated rotary and for ROB at LC No 166A are proposed with PSC I-Girders.

3.0 Documentation, Instrumentation, etc.

a. All Drawings shall be made in Latest Version of AutoCAD and the Soft Copies on CDs and ten Hard Copies of Prints of all Approved Drawings and "As Built" Drawings shall be supplied by the Contractor to the Employer at Free of Cost as per the Agreed Programme.
b. CDs and ten Hard Copies of all Approved Design Calculations shall be submitted by the Contractor to the Employer at Free of Cost as per Agreed Programme.
c. Five Video CDs of 180 minutes duration each of the Elements covering the Different Phases of Construction from Start to Finish shall be supplied by the Contractor to the Employer at Free of Cost.
d. Three Copies of "Maintenance Manual" describing Access Arrangements, Important Obligatory Precautions from the Point of View of Structural Safety and Procedure for Minor and Major Repairs of each Component of the Elements, Renewals of Finishes and Treatments periodically including Guarantee / Warranty Certificates shall be supplied by the Contractor to the Employer at Free of Cost.
e. Three Copies of "Quality Assurance Manual" covering Designs and Drawings, Mix Designs, Materials, Testing, Soil and Rock Properties, Statistical Quality Control, etc. shall be prepared by the Contractor and submitted to the Employer at Free of Cost well before Starting the Work.
f. Three Copies of “Safety Manual” covering necessary Safety and Precautions to be adopted by the Contractor as per Requirements and as per Standards during execution of the Work.
g. Three Copies of "Construction Manual" covering Various Aspects of Construction Methods, Difficulties faced and how they are overcome during Execution, etc. shall be supplied by the Contractor to the Employer at Free of Cost at the Time of Finalisation of Work.

h. The Contractor shall install Fixtures and Fastenings provided by the Employer for housing any Instrumentation that may be useful for the Employer at Contractor's Cost.
i. Fixing Arrangement for Internal and External Lighting shall be approved by the Employer and executed by the Contractor.

4.0 Programme of Submission and Approval of Designs and Drawings

The Programme for submission of Designs and Drawings is as listed out below.

Details	**Time from Award of Work**
Award of Work	0
Submission of Topographic Survey Drawing along with the Soil Investigation Report, Hydraulic Study Report, Details of Utility Mapping	4 Weeks
Horizontal and Vertical Geometrics, GAD and Construction Methodology and Schedule	5 Weeks
Traffic Diversion Schemes / Traffic Management Schemes during Construction, Quality Assurance Manual, Safety Manual, Physical Model of the Project	5 Weeks
Inception Report and Detailed Design Parameters	7 Weeks
Design and Construction Drawings of all Foundations and Preliminary Design of Entire Elevated Rotary and its approaches Structure	10 Weeks
Design and Construction Drawing of Road Over Bridge , Abutments and Reinforced earth/Retaining Walls in Approaches, all Piers and Abutments of ROB	15 Weeks
Design and Construction Drawing of all Superstructures	17 Weeks
Design and Construction Drawing of Balance Items of Work	20 Weeks
Submission of As Built Drawings, Video CD, Maintenance Manual, Construction Manual	4 Weeks after Completion of Work

The Total Period available for Submission of all Detailed Design and Drawings from the Date of Award of Work is 20 Weeks, which will be submitted in accordance with the Approved Construction Schedule.

The Design shall be submitted in Sufficient Details and as lucidly as possible so that to enable Quick Proof Checking by the Employer or his approved Representative. All the Design Calculations along with Corresponding Construction Drawings marked as "Good for Construction" will be submitted. The Corrected Designs are to be submitted as Record Designs within 15 Days of Approval of the Drawings. If the Record Designs are not submitted within this Time Frame then a Penalty at the rate of **Rs. 100000/-** per day shall be charged for every day of Delay in Submission of the Record Designs. The Corrected Designs and Drawings would be cleared within 3 weeks of submission subject to Compliance of all Points. Any other Component, which requires Redesigning on Account of Exigencies of the Site like Redesigning the Foundations for Utilities, etc. during the Duration of the Works, shall be approved as expeditiously as possible. Such Designs shall be submitted within 10 days of taking a Decision to redesign the Component. Analysis and Design shall be done using Computer with Recognised Software. The Contractor shall submit with Design, the Detailed Description of Method of Analysis with Explanatory Notes and submit Sample Manual Calculations for adequate number of Typical Cases. The Computer Programme as submitted will be further tested by Comparison with Solutions of Worked Examples. Drawings and Designs shall be in SI Units. Calculations shall be neat and clear, preferably typed and printed and supplemented by Full Explanatory Notes and Sketches wherever required. All Construction Drawings of Initial Submissions and Final Approval shall be in AutoCAD only.

If during the scrutiny of Detailed Design Calculations and Working Drawings, any Changes therein which are found necessary in the Opinion of the Employer, the same shall be incorporated without altering the Turn Key Lump Sum Quotations. It is entirely the Responsibility of the Contractor to submit properly Prepared and Completed Designs in good time to enable the Employer to approve them in time.

The Contractor shall submit 2 sets of Advance Copies of the Drawings and Design Calculations to the Employer or his approved Representative with a Forwarding Letter to the Employer. Once the Design and Drawings have been finalised by the Employer, the Contractor shall forward eight sets of Drawings incorporating Corrections, if

any, for the Final Approval.

After Completion of each Stage of Work, 3 Sets of Record Plans and One Set of Final Design Calculations based on the Work as actually executed on Site, shall be supplied by the Contractor in Bound Volumes to the Employer.

Approval to Drawings, Designs and Design Calculations by the Employer shall not in any way relieve the Contractor of his Responsibility for the Correctness, Soundness and Structural Stability and Safety of the Structure.

The Approved Drawings and the Design Calculations of the Elements shall be the property of the Employer.

The Contractor's Designer or Consultant shall compulsorily attend all the Review Meetings conducted by the Employer from time to time without any extra cost and shall also remain present as and when required during the Checking of Designs for Clarifications, if required.

As Built Drawings shall be submitted within 4 weeks from the Date of Completion of Works. Penalty of **Rs. 1000000/-** shall be levied for every week delay in submission of As Built Drawings beyond the Stipulated Deadline. An amount of **Rs. 10000000/-** shall be withheld from the Contractor's Final Bill until the As Built Drawings are submitted.

5.0 Construction Schedule

The Construction Schedule and the Methodology of Construction shall be so planned that there is Minimum Obstruction to Traffic during Construction and the entire Work can be completed in minimum possible time.

6.0 Site Office

The Contractor shall provide and maintain Furnished Site Office at the Project Location for the Supervisory Staff of the Employer and his approved Representative. It shall have minimum 40 Sqm of Floor Area and shall include all Items like Electric Supply, Electrical Items, Telephones, Lights, Fans and Complete Wiring, Drinking Water Supply and Hygienic Toilet Facilities completed along with Furniture as listed below.

i. Executive Table (for the Employer)	1 No.
ii. Executive Chair (for the Employer)	1 No.
iii. Table (for Employer's approved Site Representative, Accountant, Head Clerk and Visitors)	6 Nos.
iv. Ordinary Chair Type I (for the Employer, Accountant, Head Clerk and Visitors)	3 Nos.
v. Table (for all other Staff)	2 Nos.
vi. Ordinary Chair Type II (for all other Staff and Visitors)	6 Nos.
vii. Steel Almirah 1980mm X 915mm X 485mm	1 No.
viii. Steel Almirah 1270mm X 765mm X 440mm	1 No.
ix. Racks – 5 Tier 1800mm X 900mm X 375mm made of Slotted Angles and M.S. Sheets	3 Nos.
x. Ceiling Fans – 1400mm size. Ceiling Fans shall be of Approved Make and Colour	3 Nos.
xi. Computer with Printer, Scanner Core 15 – 650 Processor (4M CACHE, 3.20 GHZ) with 4GB DDR3 RAM, Hard Disc Capacity 500 GB, 22X DVD Writer, 17" size TFT Colour Monitor, HP / Laser Printer of 80 Columns, 104 Keyboard, Optical Mouse with Mouse Pad and HP Scanner along with Broad Band Connection	2 Nos.
xii. Photo Copier	1 No.

In addition, the Contractor shall provide a well maintained Air Conditioned Car with Driver, Fuel, etc. round the Clock for a mileage of 2500km / month for use within the Municipal Limit of Bangalore City during the entire Contract Period for the Employer and its Representatives for Supervision of Works and shall also be responsible for the Maintenance of the Car. In case of Breakdown or during Maintenance of Vehicle, Alternate Vehicle shall be provided. This shall be incidental to Work and nothing extra shall be paid to the Contractor in this regard.

Further, the Contractor shall provide and maintain Wireless Communication System during entire Contract Period (consisting of 2 Nos. of Mobile Phones with SIM Card with Bill Ceiling Limit of Rs. 2000/- per mobile per month) for use by the Employer and its Representatives. This shall be incidental to Work and nothing extra shall be paid to the Contractor in this regard.

7.0 Field Laboratory

The Contractor shall provide and maintain adequately equipped NABL Accredited Laboratory own or associated with NABL Accredited firm (NABL Accredited certificate and MOU with associated firm must be uploaded in the tender) as required for Site Control on the Quality of Material and the Works. It shall have a minimum of 40 Sqm Area. The Field Laboratory shall be located as directed by the Employer or his approved Representative. It shall be provided with Amenities like Water Supply, Electric Supply, etc. The Laboratory will have all Services, Furniture, Equipments, etc. Minimum of the following Items shall be provided in the Field Laboratory. Any Additional Items as required for Testing / Evaluation in line with the Standard Procedures and Codal Provisions shall also be provided.

7.1 General

i. Oven – Electricity Operated, Thermostatically Controlled, Range upto 200^0C, Sensitivity 1^0C	1 No.
ii. Plat form balance 300 kg capacity	1 No.
iii. Balance 20 kg Capacity – Self Indicating Type	1 No.
iv. Electronic Balance 5kg Capacity – accuracy 0.5 gm	1 No.
v. Water Bath – Electrically Operated and Thermostatically Controlled with Adjustable Shelves, Sensitivity 10^0C	1 No.
vi. Thermometers	4 Nos. each
a. Mercury – in – Glass Thermometer ranges 0 to 250^0C	
b. Mercury – in – Steel Thermometer with 30 cm Stem, ranges up to 300^0C	
vii. Glass Wares, Spatulas, Wire Gauzes, Steel Scales, Measuring Tape, Casseroles, Pans, Enameled Trays of Assorted Sizes, Pestle Mortar Porcelain Dishes, Gunny Bags, Plastic Bags, Chemicals, Digging Tools like Pickaxes, Shovels, etc.	As Required
viii. Set of IS Sieves with Lid and Pans 450mm Diameter with Sizes of 63 mm, 53mm, 37.5mm 26.5mm, 13.2mm, 9.5mm 6.7mm and 4.75mm	1 Set
200 mm Diameter of Sizes 2.36 mm, 2mm, 1.18 mm, 600 micron, 425 micron, 300 micron, 150 micron and 75 micron	1 Set
ix. Water Testing Kit for pH, SO_3 and Cl	1 Set
x. First Aid Box	1 Set

7.2 For Soils and Aggregates

i. Rifle Box	1 No.
ii. Atterberg's Limits (Liquid and Plastic Limits) Determination Apparatus	1 Set
iii. Compaction Test Equipment both 2.5 kg and 4.5 kg Rammers (Light and Heavy Compact Efforts)	1 Set
iv. Dry Bulk Density Test Apparatus (Sand Pouring Cylinder, Tray, Can, etc.) complete	1 Set
v. Speedy Moisture Meter complete with Chemicals	1 Set
vi. Posthole Auger with Extensions	1 Set
vii. Core Cutter Apparatus complete with Dolly, Rammer, etc.	1 Set
viii. Flakiness and Elongation Test Gauges	1 Set
ix. Standard Measures of 30, 15 and 3 litres Capacity along with Standard Tamping Rod	1 Set

7.3 For Cement and Cement Concrete

i.	Slump Test Apparatus	1 Set
ii.	Compression and Flexural Strength Testing Machine of 200T Capacity with Additional Diameter for Flexural Testing	1 Set
iii.	Cube Moulds for Concrete Tests	40 Nos.
iv.	Surface Moisture and Density Meter for Soil, Aggregate and Concrete	1 No.

8.0 Casting Yard

The Contractor shall make his own Arrangements for the Construction and Maintenance of Casting Yard required for the Work. The Quoted Rate shall be deemed to be inclusive of the Element of Cost towards the above.

9.0 Disputes

In case of Disputes arising between the Contractor and the Authority approving the Designs, the matter may be referred to the Chief Commissioner, BBMP. The Decision of the Chief Commissioner, BBMP shall be Final and Binding on the Contractor.

10.0 Maintenance after Defect liability period.

The maintenance is routine maintenance relatively with short-life –spans such as, wearing course, Expansion joints, paint, etc. During Maintenance period ensure the continued safety of road users. It excludes any work leading to improvement of the structures, whether by strengthening to carry heavier loads by widening or by vertical realignment of the road surface. The maintenance operation begins with the opening of the bridge to traffic. In fact, bridge member starts ageing the day its concrete is poured. It excludes repairs of any damage caused by exceptional causes like landslides, earthquakes, cyclones, fire, etc., but it includes preventive maintenance.

Maintenance of bridge structures includes washing, painting, scraping and patching of curbs, rails, deck joints, concrete and steel bridge components like keeping areas around bearings shall be kept free of debris, dust, oil / grease etc., Replacing all the loose rivets by sound rivets, Observing Cracks in steel works and taking preventive measures to arrest the propagation. Observing Corrosion and action for its prevention. Protective Coatings by painting. Maintenance painting of metallised girders. Maintenance of welded girders. Observation on Detachment of Concrete Deck Slab from Steel girder and Taking Preventive Measures. Drainage system shall be thoroughly cleaned and repaired as necessary before the onset of monsoon. Protective surface coat, where provided, shall be maintained. Cleaning to be done with hand and power tools, such as a high-pressure wash. Washing removes water-soluble surface contaminants, existing coatings, rust and oil and grease and care must be taken with the disposal of wash water and debris. Severely corroded areas of a bridge will need abrasive spot blasting and priming before painting.

For routine maintenance of steel bridge components, refer Indian Railways Bridge Manual-1998

SECTION 7: CONTRACT DATA

Items Marked "N/A" do not apply in this Contract.

The following Documents are also part of the Contract.

Clause Reference of General Conditions of Contract

1.1 The Employer: **The Chief Commissioner**
Address: **Bruhat Bangalore Mahanagara Palike**
N. R. Square
Bangalore – 560 002

Name of Authorized Representative: **Executive Engineer (RI)**
23rd Floor, Netaji Subashchandra Bose Building,
M.G. Road, Bengaluru – 560001,
Email: rieastdivisionbbmp@gmail.com

1.1 The Name and Identification Number of the Contract:
"Construction of Elevated Rotary Flyover at IOC Junction and Construction of additional 2 Lane ROB at Baiyyappanahalli Railway Level Crossing" on Turnkey - Lumpsum - Fixed Price - No Variation - No Escalation basis.

The "**Scope of Work**" is detailed in Section 6.

1.1 The Start Date shall be the **Date of Issue of Notice to Proceed with the Work**.

1.1 The project corridor is located about 13 km east of Bangalore Railway Station Bangalore city at Byapanahalli Main road straight. This junction operates Major link between Byappanahalli main roads to kammanahalli Main road through Indian Oil Depot and crossing the railway track at IOC Junction also connects Old Madras road (Indhiranagara) as well as Marathi sevanagar city. Old madras road is close to Byappanahalli Railway station and by construction of Elevated rotary flyover at IOC junction and Road Over Bridge at LC No:136A will connect NH-4 & NH-7 at Hebbal Junction, which leads to Kempegowda Internal National Airport. The Project Corridor is defined in the **Key Plan** given in Section 6.

The Intended Completion Date for the whole of the Works is 24 Months with the following milestones

Milestone dates:

Physical works to be completed Period from the date of issue of Notice to proceed with the work in the following Table

3. Insurance Requirements are as under.

Mile stones	Physical Work to be completed	Duration (Months)	Amount of Progress (Cr)	Percentage of Progress
Mile stone -1	Mobilization of Plant, Equipment, Site office. Labour Camp ,Studies / Investigations / Surveys Preparation/Finalization of GAD, shifting of utility lines, dismantaling of existing structures etc.,	1	2.20	1%
Mile stone -2	Preparation, Review, Modifications (if required) and approval of GAD and submission of approved GAD in hard copy from Railway Department, Site clearance and Dismentling.Setting out of PUP, Elevated Rotary and Road Over Bridge at LC No 136A with approaches and Establishment of Bench Mark, Preparation & submission of structural design & detailed drawings for foundation of Pier/Abutment proof checked by IIT/NITApproval of working Drawings and Designs.	4	86.17	24%
Mile stone -3	Precasting of PUP Segments, Construction of PUP, Foundation of Elevated Rotary and approach sections,Foundation of Road Over Bridge with approach section at LC No 136A: Substructure of Elevated Rotary and approach sections,substructure of Road Over Bridge with approach section at LC No 136A:	5	118.97	34%
Mile stone -4	Super structure of Rotary & ROB Flyover:	6	36.15	10%
Mile stone -5	Approaches to PUP with Rt wall and RCC stemps, Approach ramps for Elevated Rotary Flyover:Approach Ramp for Road Over Bridge at LC NO 136A:	3	34.71	10%
Mile stone -6	Service Roads including Junction improvements: At all sides of Approaches to Elevated Rotary Flyover at Grade road :Towards Baiyappanahalli Railway station to Old Madras Road :	3	32.69	9%
Mile stone -7	Battery limits, Finishing and Electrical works.:	1	24.24	7%
Mile stone -8	Over all Finishing on Completion:	1	17.36	5%
	Total Contract Period	24	352.49	100%

	Type of Cover	Minimum cover for Insurance for 12 months
(i)	Works and of Plant and Materials	The Sum stated in the Agreement plus 20%
(ii)	Loss or damage to equipment	Full Replacement Cost
(iii)	Loss or damage to property of Third Party	Full Replacement Cost
(iv)	Personal Injury or Death Insurance (a) for Third Party (b) for Contractor's Employees or Labour	Rs. 20.00 Lakh to cover 4 Persons @ Rs. 5.00 Lakh each. In accordance with the Statutory Requirements Applicable to Karnataka.

9.0 Schedule of Personnel to be deployed as below .

Sl. No	Position	Qualifications	Number of personnel
1	Project Manager	B.E. Civil + 15 Years minimum Construction experience (including 5 years as Project Manager on bridge works)	One
2	Dy Project Manager, Cum Bridge design engineer / Structural Engineers	BE (Civil) + 10 Years of which minimum 5 years' experience in design desirably Post graduate in Structural Engineering, (Min. 5 years in major Bridge Construction / Development Project.)	One
3	Bridge/Structural Engineer	BE Civil desirably Masters in Bridge Engineer Min. 5years experience	Two
4	Geotechnical Engineer	BE Civil + 3 Years minimum experience Geotechnical /Foundation engineer	One
5	Highway Engineer	BE Civil + 2 Years minimum experience in Road construction	One
6	Plant & Equipment Engineer	B.E. (Mech.) + 5 Years minimum experience OR Diploma, Mech. + 10 years minimum experience in erection and commissioning of Pumps, Plant & Mechanical equipment's	One
7	Construction Engineers	B.E. Civil + 5 Years minimum Construction experience (5 years on Road and Building construction)	Four
8	Material / Quality Control Engineer	B.E Civil + 10 Years minimum experience (including 5 years in Infrastructure works as Material / QC Engineer)	One
9	Planning Engineer	B.E Civil + 10 Years minimum experience in MS Project.	One
10	Chief Surveyor	Diploma in Civil with 12 Years minimum experience.	Two
11	Laboratory Technician	D.C.E. + 5 years minimum experience in Road , Building and bridge Construction in Q.C. Laboratory	Two
12	Electrical Engineer	B.E (Elec) 10 years minimum experience in similar nature of electrical works.	One
13	Auto CADD Draftsman	Diploma Civil + 5 years minimum experience	Two
14	Accountant	B. Com + 10 years minimum experience in Infrastructure Projects	Two
15	Store Keeper	Graduate in any discipline + 10 years minimum experience in Infrastructure Project.	Two

25. The Methodology and Program of Construction: **10 Days from the Date of Entering into Agreement**.

25. The Schedule of Key and Critical Equipment to be deployed on the Work as per Agreed Program of Construction: **10 Days from the Date of Entering into Agreement**.

17, 26 The Intended Completion Date for the whole of the Works: **24 Months from the Start Date including Monsoon**

with the Milestones as detailed in Annexure D.

31. The Defects Liability Period is **24 Months from the Date of the Physical Completion of the Work in all respects and on issuance of Completion Certificate by the Competent Authority**.

41. The Liquidated Damages for the whole of the Works are **0.1% of the Final Contract Price per day** for the whole Works.

41. The Maximum amount of Liquidated Damages for the whole of the Works: **10% of Final Contract Price**.

The liquidated damages for the whole of the works are **Rs. 352485253 /-** (amount) per day and that for the milestones are as under:

Amount in Rs	Contract Value in Rs		3524852529	
Mile stone	**No of Days Delay assumed**	**Penalty/day Rs**	**Total Amount of Penalty**	**Max Penalty 10% of Contract Value**
M-1	10	3524853	35248525.3	352485253
M-2	20	3524853	70497050.6	
M-3	20	3524853	70497050.6	
M-4	15	3524853	52872787.9	
M-5	15	3524853	52872787.9	
M-6	10	3524853	35248525.3	
M-7	5	3524853	17624262.6	
M-8	5	3524853	17624262.6	
Total	**100**		**352485253**	

42. The Amounts of the Advance Payment are

Nature of Advance	**Amount (Rs.)**	**Conditions to be fulfilled**
1. Mobilization	5% of the Contract Price	On submission of Unconditional Bank Guarantee. (To be drawn before end of 20% of Contract Period).

(The Advance Payment will be paid to the Contractor not later than 30 days after fulfillment of the above Conditions).

42. **Repayment of Advance Payment for Mobilization**
The Advance Payment shall be repaid with Percentage Deductions from the Interim Payments certified by the Employer's site Representative under the Contract in five (5) equal Installments. Deductions shall commence in the next Interim Payment Certificate following that in which the total of all such Payments to the Contractor has reached not less than 15% of the Contract Price, always provided that the Loan shall be completely repaid prior to the Expiry of the Original Time for Completion pursuant to Clauses 17 and 26.

48. The Date by which "As Built Drawings" (in scale **1:100**) in 6 Sets are required is **within 4 Weeks from the Date of Completion of Works**.

48. The Amount to be withheld for failing to supply "As Built Drawings" by the date required is **Rs. 10,00,000/- for every week Delay beyond the Stipulated Deadline**.

49.2 The following Events shall also be fundamental breach of the contract:
1. The Contractor has contravened Clause 9 of CC.

50.1 The Percentage to apply to the Value of the Work not completed representing the Employer's Additional Cost for completing the Works shall be **30%**.

SECTION 8: SPECIFICATIONS

For Specifications, all the Relevant Sections of MoRT&H [Specifications for Road and Bridge Works (Latest Editions)], all the Relevant IRCs and Special Publications (Latest Edition) shall be referred from page no 100 to 218.

Specifications are uploaded in the kppp Portal.

SECTION 9: DRAWINGS

Drawings are uploaded in the kppp Portal Tender purpose only.

SECTION 10: FINANCIAL BID

Financial Bid is uploaded in the kppp Portal.

Note:

1. Item for which no Rate or Price has been entered in will not be paid for by the Employer when executed and shall be deemed Covered by the other Rates and Prices in the Financial Bid (Refer ITT Clause 11.2 and CC Clause 37.2).

2. The Turn Key Lump Sum Fixed No Variation Price shall be quoted by the Tenderer in Indian Rupees.

3. Where there is a Discrepancy between the Price Quoted in Figures and Words, the lower of the two will govern [Refer ITT Clause 24.1(a)].

SECTION 11: FORMAT OF BANK GUARANTEE FOR PERFORMANCE SECURITY

To: _____ [Name of Employer]
_____ [Address of Employer]

WHEREAS _____ [Name and Address of Contractor] (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ [name of Contract and Brief Description of Works] (hereinafter called "the Contract");

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized Bank for the sum specified therein as Security for compliance with his Obligations in Accordance with the Contract.

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee.

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, upto a total of Rs._____ [Amount of Guarantee][2] Rupees_____ [in words] and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of _____ [Amount of Guarantee][3] as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the Terms of the Contract or of the Works to be performed there under or of any of the Contract Documents which may be made between you and the Contractor shall in any way release us from any Liability under this Guarantee, and we hereby waive Notice of any such Change, Addition or Modification.

This Guarantee shall be valid until 30 days from the Date of Expiry of the Maintenance Period of 36 months plus Claim Period of 6 months.

Signature and Seal of the Guarantor:
Name of Bank:
Address:
Date:

[2] An Amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract.

[3] An Amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract.

GENERAL NOTES

1. The Financial Bid is to be read, for the purpose of pricing, in conjunction with the Instructions to Tenderers, Conditions of Contract, Scope of Work, Design Criteria, Specifications, Drawings and all other Component Parts of the Tender Document.

2. The Contractor shall quote the **Turnkey, Lump Sum, Fixed Price, No Variation Offer** for Investigation, Planning, Designing, Construction, Testing and Commissioning, etc. for **"Construction of Elevated Rotary Flyover at IOC Junction and construction of additional 2 Lane ROB at Baiyyappanahalli Railway Level crossing.'**as per the format given in the **Form of Financial Bid**. The **Turnkey, Lump Sum, Fixed Price, No Variation –No Escalation basis**

3. Quoted rate shall be for the entire Scope of Work with all General Risks, Liabilities and Obligations set forth or implied in the Document on which the Tender is to be based. Variation in Quantities due to Site Requirement does not entail a Contractor for any revision in the Quoted Offer.

4. The **Turnkey, Lump Sum, Fixed Price, No Variation Offer** shall include Cost of all Materials (including Cost of Cement, Reinforcement Steel, Explosives, etc.), Plant, Labour, Equipment, Lighting, Conveyance, Planning and drawing of Utility Shifting, Tree Transplantation, Rainwater Harvesting , Providing and Maintaining Communication Facilities, etc., all Leads and Lifts for various Components of Elevated Rotary with Steel Box Girder, Pedestrian Underpass, Rail Over Bridge at LC 136A with composite I Girder , Ramps /Approaches with PSC I girder , Surface Level Roads including Regrading / Resurfacing / Widening of Surface Level Roads, Improvements to Carriageway, Drainage Facilities, Illumination, Footpath, Diversion of Traffic, Cross Drainage Works, Painting, Providing Over Head Gantry, Providing Traffic Signals and Signages, Road Marking, etc. under all Conditions of Site, Weather, etc. as specified in **Volume I**. The Amount offered shall be Final and no claim whatsoever on any account shall be entertained.

5. The **Turnkey, Lump Sum, Fixed Price, No Variation Offer** shall be inclusive of all Taxes, Duties and Levies including GST, Sales Tax, Service Tax, Municipal Taxes, Local Taxes, Octroi, ESI, all Royalties, Patent Rights, other Incidental Charges, etc.

   The Contractor shall quote his **Turnkey, Lump Sum, Fixed Price, No Variation Offer** by taking into consideration the Minimum Cement Content specified in **Volume I** of this Tender Document.

   The Contractor shall absorb the Cost in case of any necessity of Cement Content required to be adopted being above the Upper Limits specified. No Compensation will be paid on Account of Variation in the Quantity of Cement beyond the Range specified and also the Contractor will not be compensated for any Variation in Cement Content as a Result of Variation in Gradation of Fine and Coarse Aggregates.

6. All Items shall be executed as per the Tenderer own design approved Designs and Drawings and shall comply with the Specifications, Conditions of Contract, Design Criteria of the Tender Document and Orders conveyed by the Employer or his Representative from time to time during the Course of Execution. If there are any Items in Contract Proposals, which is not specified in **Volume I**, shall comply with the Specifications specified in relevant IRC and BIS Codes, MoRT&H.

7. The **Turnkey, Lump Sum, Fixed Price, No Variation Offer** quoted shall include Clearance of Site both Prior to Commencement of Work and after its Completion.

8. The **Turnkey, Lump Sum, Fixed Price, No Variation Offer** quoted rate shall include the **Road Works related to Diversion of Roads** as per the Approval of the concerned Department. The Employer shall not be Responsible for any Variation in the Quantities in this regard.

9. The **Turnkey, Lump Sum, Fixed Price, No Variation Offer** quoted rate shall include the identification of Permanent **Utility Shifting** and preparation of utility shifting drawings as per the approval of the concerned Departments and excludes utility shifting charges. The Employer shall only assist in liaison with concerned departments and expenditure towards shifting charges as demand by concerned departments shall be borne by the employer.

10. The Contractor shall specifically note that the **Turnkey, Lump Sum, Fixed Price, No Variation Offer** quoted shall be inclusive of all Dewatering and Desilting necessary for completing the Works. No Separate Payment shall be made towards Dewatering and Desilting.

11. Where there is a Discrepancy between the Price Quoted in Figures and Words, the Lower of the two will govern.

12. Disposing of all the Disused Materials shall be the Responsibility of the Contractor.

13. The **Turnkey, Lump Sum, Fixed Price, No Variation Offer** quoted shall include all Safety and Precautionary Measures to be followed at Site during the Course of the Execution.

Form of Financial Bid

Description of the Works: **Construction of Elevated Rotary Flyover at IOC Junction and Construction of additional 2 Lane ROB at Baiyyappanahalli Railway Level Crossing"** on Turnkey - Lump sum - Fixed Price - No Variation - No Escalation basis.

To
The Executive Engineer (RI)
23rd Floor, Netaji Subashchandra Bose Building,
M.G. Road, Bengaluru – 560001,
Email: rieastdivisionbbmp@gmail.com

Dear Sir

We _____ offer to construct and maintain during the Defects Liability Period and Maintenance Period the Works described above in accordance with the Terms and Conditions, Scope of Work, Conditions of Contract accompanying this Tender for the Turnkey Lump Sum Fixed No Variation Contract Price as indicated in **Schedule A**.

This Tender and your Written Acceptance of it shall constitute a Binding Contract between us. We understand that you are not bound to accept the lowest or any Tender you receive.

We undertake that, in competing for (and, if the award is made to us, in executing) the above Contract, we will strictly observe the Laws against Fraud and Corruption in Force in India namely "Prevention of Corruption Act 1988".

We hereby confirm that this Tender complies with the Tender Validity and Earnest Money Deposit required by the Tender Documents.

We attach herewith our Current Income Tax Clearance Certificate.

Yours faithfully

Authorized Signature:

Name and Title of Signatory:
Name of Tenderer:
Address:

Schedule A

Sl. No.	Description of Work	Amount in Figures[1]	Amount in Letters[1]
1.	Construction of Four lanes Elevated Rotary at IOC railway junction with Steel Box Girder and approaches to all the four directional flow of traffic, including approaches to Railway maintenance shed inside railway property near junction and Construction of Pedestrian Underpass complete as per concept drawings enclosed in Tender drawings. B. Construction of two lanes ROB in lieu of LC NO: 136A at KM 345/800-900 between Bengaluru cantonment and Byyapanahalli Railway stations with obligatory span of 2 x 35.0M clear composite Girder with both side approaches. Down ramp towards Byappanahalli station on LHS of existing ROB and other side approach towards Old Madras Road with up ramp to facilitate the flow of traffic in unidirectional as per concept drawings enclosed in Tender drawings. C. Construction of at grade Road from Battery limits of approaches to Elevated rotary from all the four side approaches, including Byyapanahalli railway station roads to Old madras road NH 7 Junction.		
	TOTAL		

[1] To be filled in by the Tenderer, together with his Particulars and Date of Submission at the Bottom of the Form of Tender.

TECHNICAL SPECIFICATIONS

SPECIFICATION FOR SUPER - STRUCTURE OF BRIDGES.

1.0 Books of reference

For the guidance of the bidder, list of the reference books, codes and manuals are given herewith. The list is only tentative. Additional documents as per the requirement of the engineer be referred to. Bidders are required to adhere to the latest instructions, updated versions and revised editions of the documents.

Railway / IRS books of reference:

i. IRS Rules Specifying the Loads for Design of Super-Structure and Sub-Structure for Bridges (Bridge Rules)

ii. Indian Railways Standard Code of Practice for the Design of Steel or Wrought Iron Bridges Carrying Rail, Road or Pedestrian Traffic (Steel Bridge Code).

iii. IRS Code of Practice for Metal Arc Welding in Structural Steel Bridges Carrying Rail, Rail-cum-Road or Pedestrian Traffic (Welded Bridge Code).

iv. IRS Specification for Fabrication and Erection of Steel Girder Bridges and Locomotive Turn-Tables: Fabrication Specification (B1).

v. IRS Code of Practice for Plain, Reinforced & Pre stressed Concrete for General Bridge Construction (Concrete Bridge Code).

vi. Indian Railways Schedule of dimensions for Broad Gauge - 2005.

vii. Indian Railways Bridge Manual, 1998.

viii. Indian Railways P. Way Manual. 2004.

ix. Indian Railways Works Manual. 2000.

x. M-3: Class I, II, III and IV steel forgings, blooms for forging and billets for rerolling.

xi. M-28: Classification, Testing and approval of metal-arc welding electrodes for use on Indian Railways.

xii. M-39: Classification, testing and approval of submerged arc welding wire flux combination.

xiii. M-41: Corrosion resistance steel.

xiv. M-42: High strength low alloy structural steel with enhanced corrosion resistance.

xv. M-43: High strength low alloy structural steel rivet bars with enhance corrosion resistance.

xvi. P-31: Zinc chromate red oxide primer.

xvii. M&C/PCN/102/96: Epoxy zinc phosphate primer.

xviii. M&C/PCN/103/86: Epoxy micaceous iron oxide.

xix. M&C/PCN/109/88: Polyurethane red oxide.

xx. M&C/PCN/110/88: Polyurethane aluminium.

xxi. M&C/PCN/111/88: High build epoxy paint.

xxii. RDSO/M&C/Specification: Classification, testing and approval of CO_2 weldingfiller wires for use on Indian Railways.

Indian Roads Congress codes and specifications:

i. IRC-21: Standard specifications and Code of practice for Road Bridges- Sections –III- Cement concrete (Plain & reinforced).
ii. IRC-24: Standard specifications and Code of Practice for Road Bridge –Section –V- Steel Road Bridges.
iii. IRC- 83: Bearings for bridges.
iv. IRC-87: Design and erection of false work for road bridges. Indian Standards Codes &

Specifications:

1) IS: 2062 –2011 Steel for general structural purposes. (new code includes theprovisions of IS:1077 & IS: 8500)
2) IS: 1786- High strength deformed steel bars & wires for concrete reinforcement.
3) IS: 1148- Hot rolled rivet bars (up to 40mm dia) for structural purposes.
4) IS: 1149- High tensile steel rivet bars for structural purposes.
5) IS: 1929 – Hot forged steel rivets for hot closing (12 to 36mm dia)
6) IS: 2004 Carbon steel forgings for general engineering purposes.
7) IS: 57 – Red lead for paints and other purposes.
8) IS: 75 – Linseed oil, raw and refined.
9) IS: 77 – Linseed oil, boiled for paints.
10) IS: 102 Ready mixed paints, brushing, red lead, non-settling, priming.
11) IS: 123 – Ready mixed paints, brushing, finishing, semi-gloss, for general purposes to Indian Colours etc.
12) IS: 2339- Aluminum paints for general purposes, in dual container.
13) IS: 280- Mild steel wire for general engineering purposes.
14) IS: 456- Plain and reinforced concrete.
15) IS: 883 – Design of structural timber in buildings.
16) IS: 814- Covered electrodes for manual metal arc welding.
17) IS: 1182- Radiographic examination of butt joints in steep plates.
18) IS: 2595- Radiographic testing.
19) IS: 383- Coarse and fine aggregates from natural sources for concrete.
20) IS: 2386 (all 8 parts) – Tests for aggregates for concrete.
21) IS: 3025 (all 49 parts) – Methods of sampling and test for water and waste water.
22) IS: 1791 – Batch type concrete mixers.
23) IS: 4634- Methods of testing performance of batch type concrete mixers.
24) IS: 6925- Methods of test for determination of water-soluble chlorides inconcrete

admixtures.

25) IS: 9103 – Admixtures for concrete.

26) IS: 516 – Method of test for strength of concrete.

27) IS: 4031 (all 15 parts) - Physical tests for hydraulic cement.

28) IS: 5513- Vicat apparatus.

29) IS: 10080- Vibration machine for casting standard cement mortar cubes.

30) IS: 10262- Concrete mix design.

31) IS: 1343 – Prestressed concrete.

32) IS: 875 (all 5 parts) – design loads (other than earthquakes) for buildings and structures.

33) IS: 2720 (all 41 parts)- Method of tests for soils.

34) IS: 800 General constructions in steel.

35) IS: 786- Conversion factors and conversion tables.

36) IS: 1024 – Welding in bridges and structures subject to dynamic loading.

37) IS: 1261 - Seam welding in mild steel.

38) IS: 1367 (all 20 parts) - threaded steel fasteners.

39) IS: 6639- Hexagonal bolts for steel structures.

40) IS: 104 – Ready mixed paint, brushing, zinc chrome, priming.

41) IS: 2074- Ready mixed paint, air drying, red oxide-zinc chrome, priming.

42) IS: 1852- Rolling and cutting tolerances for hot rolled steel products.

43) IS: 1270- Metric steel tape measure.

44) IS: 9595- Metal Arc Welding.

45) IS: 487- Brush, paint and varnish.

46) IS: 1030 – Carbon steel castings for general engineering purposes.

47) IS: 3400 (all 22 parts) - Methods of tests for vulcanized rubbers.

48) IS: 1915- Steel bridge code

49) IS: 1893- Earthquake resistant design of structures.

50) IS: 3502- Steel Chequered plates.

51) IS: 3085- Method of test for permeability of cement mortar and concrete.

52) IS: 7320 – Concrete slump test apparatus.

53) IS: 5515- Compaction factor apparatus.

54) IS: 6586- Metal spraying for protection of iron steel.

55) IS: 5666- Etch primer.

56) IS: 3955- Design and construction of well foundations.

57) SP 6, 7, 16, 21, 22, 23, 24, 34, 36, 52, 60.

58) IS: 2911- Design and construction of pile foundation.

59) IS; 7205- Safety code for erection of structural steel work.

60) IS: 8629- Protection of iron and steel structures form atmospheric corrosion.

61) IS: 5624- Foundation bolts.

62) IS: 7215- Tolerances for fabrication of steel structures.

63) IS: 8112- 43 Grade OPC.

64) IS: 4326- Earthquake resistant design and construction of buildings.

65) IS: 13920- Ductile detailing of reinforced concrete structures subjected to seismic forces.

66) IS: 34 – White lead for paints.

67) IS: 887 – Animal tallow.

68) IS: 816- Metal arc welding for general construction in mild steel.

69) IS: 819- Resistance spot welding for light assemblies in mild steel

70) IS: 1024 – Welding in bridges and structures subject to dynamic loading.

71) IS: 1261- Seam welding in mild steel.

72) IS: 1323- Oxy-acetylene welding for structural work in mild steel.

73) IS: 4081- Safety code for blasting and related drilling operations.

74) IS: 3764- Safety code for excavation work.

75) IS: 7293- Safety code for working with construction machinery.

76) IS: 817- Training and testing of metal arc welders.

77) IS: 1200 (all relevant parts)- Method of measurement of building and civil engineering works.

78) IS: 2132- Thin walled tube sampling of soils

79) IS 2131- Standard penetration test for soils.

Miscellaneous:

i. UIC-772R: Bearings of rail bridges.

ii. BS-5400 (all parts)

iii. BS-1449, 3484, 1134, 5296

iv. ASTM/AASHTO

Note: The books of reference shall also include further references mentioned in above mentioned books of references. All the books, references and codes shall be of latest edition with up to date correction slips.

1.1 GENERAL:

The girders shall be steel girders or Concrete members as per approved drawings. Cast-in-situ method may also be adopted if approved by the Engineer for other members of the structure.
Steel grade conforming to IS: 2062-2011 (with latest amendment), is proposed to be used for all components for all spans as per approved drawings.

The steel shall comply in all respects with the requirements of approved drawings and relevant codes and specifications and shall be procured from approved manufacturers only. It may be noted that quality of steel used for fabrication shall be the essence of the contract & shall be rigidly followed. Steel sections to be supplied by the manufacturers shall be Ultrasonically tested as per codal provisions at the manufacturer's premises before dispatch. The Contractor on receipt of supply in his factory premises/fabrication workshop shall carryout random USFD testing as per standards laid down in various codes and verify them with the list received from manufacturers. Only tested steel shall be used for fabrication. All rolled sections shall bear cast mark and shall be of such length as to avoid butt welded joints in components of truss. Such rolled sections shall be within rolling tolerances stipulated as per IS:1852 and shall be defects free.

(i) Only wieldable steel conforming to IS: 2062 Steel fusion welding quality shall be used for fabrication of Steel Channels Sleepers.

(ii) No Re-rolled Steel should be used.

(iii) Steel should be procured only from SAIL, RINL, TISCO or JINDAL such reputed steel manufacturers only. The source of steel should be got approved by the Engineer / Employer.

(iv) In support of purchase copy of vouchers are to be submitted.

The tenderer(s) shall supply information in the tender regarding source/manufacturers from where procurement of steel is proposed by him/them. However, the usage of type and grade of steel may vary during the execution of the work depending upon the design requirement and market availability. No claim shall be entertained from the Contractor on this account and payment shall be as per relevant items in the schedule of items, quantities and rates.

Steel for rivets shall conform to IS:1148 for M.S and IS:1149 for H.T.S.

Welding consumables for Manual Metal Arc Welding (MMAW) shall conform to IRS-M-28, wire and flux combination for submerged arc welding to IRS M-3 and filler wires for CO_2 welding to RDSO/M&C/Specification issued vide letter No. M&C/W/111/24 dated 1.1.1994/7.2.1994.
All welding consumables (electrodes, wire, flux etc.) shall be procured only from the manufacturers approved by RDSO subject to final approval by Engineer.

All materials for the work shall pass tests and/or analysis prescribed by the relevant IS specifications or such other equivalent specifications.

For all materials including rivets and bolts, the Contractor shall furnish copies of test certificates from the manufacturers including proof sheets, mill sheets etc. showing that the

materials have been tested in accordance with the requirements of various specifications and codal provisions.

If any further testing of materials is required by Engineer in respect of these and other items, it shall be arranged for by the Contractor at a reputed laboratory/National test house as approved by Engineer. For this, nothing extra shall be payable and accepted rates in the schedule of items, quantities and rates shall be deemed to include this.

Even satisfactory outcome of such tests or analysis shall in no way limit, dilute or interfere with the absolute right of the Engineer to reject the whole or part of such materials supplied, which in the judgment of the inspecting authority does not comply with the conditions of the contract. The decision of the Engineer in this regard shall be final, binding and conclusive for all purposes.

1.2 The contractor should prepare Quality Assurance Plan (QAP) based on RDSO guidelines for fabrication of girders and get the same approved from the Engineer before proceeding with the work. Girders should be got fabricated by a firm who has full fledgefabrication workshop and should have valid certification of RDSO for fabrication of girders. Any another procedure will require approval of Engineer.

2.0 ASSEMBLING / ERRECTION OF STEEL

GIRDERS Fabrication and Workmanship

2.1 General

Fabrication, Workmanship shall generally comply with current IRS specification No. B1-2001 with latest correction/amendments thereof unless otherwise specified in special conditions of this contract or as specially directed by the Engineer in writing.

The fabrication of the girders and its accessories shall be carried out by the Contractor in his factory premises or in a well-established fabrication workshop to be set up by the Contractor at bridge site or any other location as approved by the Engineer. The workshop staff shall have requisite experience, proven skill and experience in the technique of fabricating large components. Accuracy of fabrication shall be realized through controlled high precision jigs, fixtures and templates, which shall be inspected and passed by Engineer / any other inspection agency as nominated by Engineer. The fabrication shall be preceded by Quality Plans to be submitted by the Contractor and every activity shall be documented in detail. The Quality Plans shall clearly indicate how individual processes such as cutting of raw steel, marking, drilling, assembly, riveting/welding, painting, handling etc. shall be monitored for quality. The quality parameters for monitoring shall be identified along with monitoring frequency and quality records to be maintained. The officials responsible for monitoring these identified quality parameters shall also be specified in these quality plans. The Contractor shall get these quality plans approved from Engineer before start of fabrication work. The Engineer shall be empowered to check the manufacturing process from time to time to ensure that the work is executed as per approved quality plans. The quality records shall be submitted to Engineer for record, after completion of fabrication work.

The work of fabrication in Contractor's fabrication shop will at all times be open for inspection by Engineer or any other agency as nominated by Engineer. Before dispatch of fabricated steel work from the shops the same will be inspected in the Contractor's fabrication workshop by Engineer or any other authority/agency nominated by Engineer who will thereafter issue inspection certificate.

Any defects noticed during inspection in the execution of work shall be rectified or replaced by the Contractor at his own cost. The decision of Engineer or any other agency nominated for inspection as to the existence of the defect, the manner in which the defective work has to be rectified or replaced, shall be final and conclusive.

In the fabrication of girder, necessary arrangement and provision shall be kept for inspection facilities underneath the girder and also for carriage of service cables, pipe lines etc. as per approved plan.

2.2 Fabrication Drawings

The Contractor shall prepare detailed shop drawings including drawing office dispatch lists (DODL's) on the basis of design drawings supplied by Engineer, in such size and in such details as may be specified by Engineer. The shop drawings shall be submitted to Engineer

in triplicate, one copy of which will be returned after scrutiny and approval. The fabrication drawings shall indicate member sizes prior and after flame cutting, machining to obtain correct length and shape, tolerance provisions, welding sequence, type and size of welding. No work of fabrication will be started without such approval being obtained. Engineer will make all efforts to approve the drawings submitted by the Contractor within reasonable time but no claim from Contractor for any delay on this account shall be entertained by Engineer.

For Engineer's use and record, the Contractor shall supply free of charge, four sets of prints on strong paper and one set of neatly executed tracings of all approved detailed drawings and fabrication drawings, soon after communication of approval, for use at site.

2.3 Maintenance of records by Fabricators

The records of fabrication shall be maintained in the registers as per the formats given in the Appendix I of B-1 Specification. For ready reference, extract of the same has been given in the end of this specification as well.

2.4 Tolerances in Fabrication

Fabrication tolerance for girders shall be as stipulated in Appendix II of IRS-B1-2001 (with latest revision). Permissible deviation for driven rivets shall be as stipulated in Appendix-IV of IRS-B1-2001 (with latest revision).

2.5 Testing of the Materials

In addition to the test certificate obtained from the steel producers/suppliers/dealers, for conformity sake, all materials/consumables, i.e. steel, rivets, welding electrodes, paints, etc shall be got tested from the NABL approved labs/recognized labs. Proper record of all such test results shall be maintained. A copy of the same be given to BBMP/Railways as well. Test result of the supplier and that of the lab should match with each other. In case of major difference, mater has to be investigated. Decision of the BBMP/Railways shall be final in that regard.

Rolled steel shall also be ultrasonically tested by the reputed firm. Only ultrasonically tested steel shall be used for fabrication work. Record of ultrasonically tested steel shall be maintained separately.

All the testing work shall be done in accordance to the provisions of the relevant codes.

Regarding radiographic testing/x-ray testing of the welded joints, matter shall be finalized in consultation with the inspecting authority, i.e. RDSO. Agreed to procedures shall be followed. Necessary arrangement for that has to be got done by the tenderer at their own cost.

All testing work shall be got done by the contractor at their own cost. Nothing extra shall be paid. Tenderers should quote their rate accordingly.

2.6 Fabrication / Manufacture

The whole work shall be representative of the highest class of workmanship. The greatest accuracy shall be observed in the design, manufacture and erection of every part of the work to ensure that all parts will fit accurately together on erection. For manufacture of the

components of all spans to be made strictly interchangeable as specified in 'interchangeability' criteria given in this specification on the subsequent pages, approved set of same jigs and assembly fixtures shall be used. The tolerances in manufacture shall be in accordance with as shown in Appendix III of IRS B-1-2001 Specification. For ready reference, the same are also produced in the end of this technical specification (Quality control portion of this specification).

The Contractor shall state which of the following alternative methods of manufacture he/she intends to adopt.

a). The whole of work to be erected complete and pieces marked to place.

b). All spans to be made strictly as per the interchangeable criteria described subsequently of this technical specification.

The Contractor shall maintain a master steel tape of approved make for which he/she has obtained a certificate of accuracy from any National Test House or Government recognized institutions, competent to do so.

2.7 Templates

The templates throughout the work shall be of steel. The template shall be used for marking of cutting material and as well as profile machining for girders of railway loading. Templates shall be used for marking of drilling holes in steel structures other than girder of railway loadings. In case where actual materials from a bridge have been used as templates for drilling similar pieces the Inspecting Officer will decide whether they are fit to be used as part of the finished structure.

The contractor shall supply and provide templates at his own cost. No separate payment shall be made for this and accepted rates shall be deemed to include this aspect. The templates used for the work shall be of steel and of tested quality.

2.7.1 Template Shop

(i) Fully covered template shop consisting of uninterrupted steel or concrete floor as approved having true and correct level covering adequate area shall be provided by the contractor.

(ii) Camber layout shall be drawn to full scale from end of girder to half span. This camber layout once approved shall be used for fabrication of master gusset profiles and end profile of each member. It shall be used for working out the actual lengths of each member and checked to conform to the calculated length.

(iii) Master gussets at every panel joint of top chord, bottom chord and middle web panel shall be marked accurately on camber layout drawn on template floor.

(iv) All precautions shall be taken while drawing camber layout for correct setting of angle of intersection of chord and web member and great accuracy shall be ensured while transferring the same on master gusset. While marking centre point of field

rivet holes on master gusset, if there is symmetry of holes on vertical axis, marking shall be made only on half the master gusset across vertical axis, and holes drilled by inscribing each hole. Subsequently remaining half portion shall be drilled through gusset using the same half portion master gusset. This will help realize symmetry of holes in gusset and fairing of field rivet hole during girder assembly. Camber layout and fabrication of Master gusset at every panel joint requires highly skilled and trained staff experienced in accurate fabrication of largegirders, drilling jigs and fixtures. At least one jig shall be required for each component. Each jig shall be numbered and a record kept in register for identification.

2.8 Flattening and Straightening

All steel materials, plates, bars and structural shall have straight edges, flat surfaces and be free from twist. If necessary, they shall be cold straightened or flattened by pressure before being worked or assembled unless they are required to be of curvilinear form. Pressure applied for straightening or flattening shall be such as it would not injure the material and adjacent surfaces or edges shall be in close contact or at uniform distance throughout. Flattening and straightening under hot condition shall not be carried out unless authorized and approved by the Inspecting Officer.

2.9 **Planning and Shearing**

Except where otherwise indicated, cutting of all plates and sections shall be affected by shearing or sawing. All edges shall be clean, reasonably square and true. Wherever possible the edges shall be cut in a shearing machine, which will take the whole length of the plate in one cut.

As per direction of the engineer, if required, the cut edges shall be ground afterwards. planning or machining of the edges or surface shall be carried out when so specified in the contract drawings or where specifically ordered by the Engineer. Where machining is specified, the plates or all sections shall be cut in the first instance to such a size so as to permit not less than 3mm of metal being removed from each sheared edge or end, in the case of plates or sections of 12mm or less in thickness and not less than 6mm of metal being removed in the case of plates and sections exceeding 12mm in thickness. The butting ends of all booms and struts where spliced shall be faced in an end milling machine after members have been completely fabricated. In the case of compression members the face shall be machined so that the faces are at right angle tothe axis of the members and the joint when made, will be in close contact throughout. At the discretion of the Inspecting Officer, a tolerance of 0.4mm may be permitted at isolated places on the butting line.

All marking and checking of master gussets, camber layout, etc shall preferably be at the mean temperature of the fabrication zone.

2.10 **Flame cutting**

Flame cutting by mechanically controlled torch/torches shall be accepted both in the case of mild steel and high tensile steelwork. Provided the edge as given by the torch is reasonably clean and straight, plates may be cut to shape and beams and other sections cut to length with a gas-cutting torch, preferably oxyacetylene gas should be used. All flame cut edges shall be ground to obtain reasonably clean square and true edges. Draglines produced by flame cut should be removed. Unless machining has been specifically provided for, special

care is to be taken to ensure that ends of all plates and members are reasonably in close contact and the faces are at right angles to the axis of the members and joints, when made, are also reasonably in close contact. Use of multi-head flame cutting machine having multiple oxy acetylene torches is desirable for higher productivity and reducing the distortion due to cutting operation. Plasma-arc cutting method can also be employed. This process offers less heat input causing less distortion.

2.11 **Drilling and Sub-punching**

All holes shall be drilled but the Contractor may, if he/she so prefers sub-punch them to a diameter 6mm less than that of finished holes, e.g. a punched hole which is to be drilled out to 25mm in diameter shall not exceed 19mm in diameter at the die end. When the rivet holes are to be sub-punched, they shall be marked with a center punch and made with a nipple punch or preferably, shall be punched in a machine in which the position of the hole is automatically regulated. The punching shall be so accurate that when the work has been put together before drilling, a gauge 1.5mm less in diameter than the size of the punched holes can be passed easily through all the holes. Holes for countersunk heads of rivets, bolts or screws shall be drilled to the correct profile so as to keep the heads flush with the surface Holes for countersunk heads of rivets, bolts or screws shall be drilled to the correct profile so as to keep the heads flush with the surface. No sub-punching shall be allowed in the main truss members of open-web girders. Holes for turned bolts should be 1mm under drilled in shop and should be reamed at site to suit the diameter of turned bolt.

Where the number of thicknesses to be riveted exceeds three or the total thickness is 90mm or more, the rivet holes, unless they have been drilled through steel-bushed jigs, shall be drilled out in place 3mm all round, after assembling. In such cases the work shall be thoroughly bolted together.

The steel bushes shall be case hardened by an approved process and checked for diameter after the heat-treatment. The bores of bushes shall initially have a tolerance of -0mm, 0.1mm. The tolerance shall be checked from time to time and when the bores exceed a tolerance of, -0mm, +0.4mm, the bushes shall be rejected. For this purpose, go and no-go gauges are to be used. Tolerances for checking jigs from master plates shall be +0mm -0.13mm.

The work shall be taken apart after drilling and all burrs left by the drill and the sharp edges of all the rivet holes completely removed.

2.12 **Parts in Contact**

All steel work intended to be riveted or bolted together shall be in contact over the whole surface.

Drifts as shown in Fig. No.-1 may be used for drawing light members into position but their use on heavy members should be restricted to securing them in their correct positions. In no case, shall drifting be allowed to such an extent that holes are distorted.

Drifting to enlarge unpaired holes is prohibited. The holes that will have to be enlarged to admit rivets should be reamed provided the Engineer permits such reaming after satisfying

himself about the extent of inaccuracy and the effect of reaming on the soundness of the structure. The Purchaser retains the right to reject all steel work if the holes are not properly matched.

2.13 **Making of Joints**

Cleaning of permanent contact surfaces: Surfaces which will have permanent contact shall be removed of paints and mill scale down to bare metal, clean and dried and immediately a coating of red lead to IS: 102 shall be applied. Care shall be taken to see that all burrs are removed and no surface defects exist before the parts are assembled. Bolting and drifting: Only barrel drifts as per Fig. No.-1 shall be used in erection. They may be used for drawing light members into position; but their use on heavy members shall be restricted to securing them in their correct position. Any apparent error in shop work, which prevents the assembling and fitting up of the parts by the proper use of these drifts, shall be investigated immediately. As all work is rigidly inspected in the manufacturers work before dispatch, these difficulties should not arise and the cause should be first be sought in the use of incorrect components or the transposition of a correct part. It is usually important that parts should be correctly handled. Should error still persist, the matter shall be immediately reported to the Engineer who will decide what action is to be taken. No reaming shall be undertaken without the written authority of the Engineer, except for the under drilled holes meant for turned bolts. If approved, the Contractor shall supply, at his/her own expense, any special rivets that maybe required. Copies of all correspondence relative to the recourse to reaming and the use of over-size rivets shall invariably be sent by the Engineer for information to the inspectorate concerned.

Joints shall normally be made by filling not less than 50% of the holes with service bolts and barrel drifts in the ratio of four to one. The service bolts are to be fully tightened up as soon as the joint is assembled.

Special methods of erection other than described in Appendix III of IRS B-1-2001 Specification: In cases where the joints have to withstand stresses arising from special method of erection, provision is to be made to take the whole stress that will or may occur. Cylindrical drifts and turned bolts shall be used to withstand such stresses and no reliance is to be placed on the service bolts for this purpose. Up to maximum of 40% of the holes of each member of the joint are to be filled with drifts and balance of strength required is to be attained with turn bolts. The Engineer will intimate the position and number of the drifts and bolts. The condition of "Making of Joints" of this technical Specification must be observed and the bolt fully tightened up as soon as the joint is made.

Where the manufacturing of girders has been done in accordance with "Interchangeability" of this specification relating to steel girder bridges, the erection shall be done in accordance with Appendix III of IRS B-1-2001 Specification. However, if the Contractor desires to adopt any other method of erection, he/she shall submit the scheme and obtain the approval of the Engineer. It shall be ensured that when in position, the girder has the camber as per drawing.
In the event of an emergency arising such as the staging is in danger of being carried away by floods before the riveting can be completed, the joints shall be made secure by filling

40% of the holes with cylindrical drifts and equal number with service bolts fully tightened.

2.14 R**ivets and Riveting**

The dimensions on the drawings referred to the diameters of the rivet holes and their finished rivets. The rivet holes shall be 1.5 mm greater than the diameter of the rivet bars used. The rivets shall be made to IS: 1929. The shanks of the un driven rivets shall be made of a length sufficient to fill the holes thoroughly and form the head. The clearance i.e. the difference in diameter between the rivets measured under head before being heated and the rivet hole shall not be less than 0.75mm. Before riveting is commenced, all works shall be properly bolted so that the sections riveted are in close contact throughout. Rivets shall completely fill the holes and shall be machine driven by means of pressure or percussion riveters of approved design.

All rivets shall be properly heated to straw heat for the full length of the shank, firmly backed and closed. The head of the rivet, particularly in long rivets, shall be heated more than the point and in no case shall the point be heated, more than the head. Sparking or burnt rivets shall not be used. Where it is impossible to back up by normal method of holding up, 'double gunning' may be resorted to. Alternatively, pneumatic holding device may be used.

Gauges for rivet dimensions and contours shall be provided by the Contractor for the use of the Inspecting Officer.

Rivets when driven shall completely fill the holes, have the heads concentric with the shanks and shall be in full contact with the surface. Driven rivets when struck sharply on the head with the 110-gm. rivet testing hammer, shall be free from movement or vibration.

While riveting built-up members, full care should be exercised to ensure that the set of holes for field rivets in each flange of the built-up member, is aligned dead-square in relation to that in the other flange and not 'aborted'. Use of assembly fixtures shall be made to ensure this.

All loose and burnt rivets and rivets with cracks, badly formed, eccentric or deficient heads shall be cut out and replaced. Permissible deviation of driven rivets shall be as per Appendix IV of IRS B-1-2001 Specification. For ready reference, the same has been produced in the "Quality Control" part of this technical specification. Rivets shall also be cut out when required for the examination of the work. Actual method of cutting out shall be approved by the Engineer. Recupping and caulking shall in no circumstances be resorted to.

Riveting shall not be started until such time as the Engineer has personally satisfied himself that the alignment of the girders is correct, the verticals plumb laterally, the camber according to that shown on the camber diagram with camber jacks screwed tight, all the joints and cover plates well up, service bolts tight and field rivet holes coinciding. Special care should be taken that service bolts are frequently re-tightened as the riveting proceeds.

All field rivets shall be tested as directed by the Engineer. Where practicable all riveting shall be done by pneumatic or hydraulic rivetting machine. The working pressure to be employed when using pneumatic or hydraulic tools shall be approved by the Engineer.

Hand rivetting shall only be done when sanctioned by the Engineer. In such cases, means shall be adopted to ensure the rivets being used in their entire -only to give the correct form of head. When all the rivets of joints have been finally passed, they shall be painted as under. One coat of ready mixed zinc chrome primer to IS: 104 followed by one coat of ready mixed paint red oxide zinc chrome primer to IS: 2074.

Finishing coat as per painting schedule given under "Oiling, Painting and Metallizing" of this technical specification. For further details on the rivetting, "Indian Railways Bridge Manual" can be referred to.

2.15 Field rivets, Bolts, Nuts and Service Accessories

Fabricators shall arrange rivets, bolts, nuts, drifts and service accessories, etc. for all those works required as a part of shop fabrication. For field erection and assembly work, it shall be the responsibility of launching/ erection contractor to arrange such type of fittings.

2.16 Smithed Work

All joggles shall be performed by pressure. Craned sections or knees can be formed by forging or by gas cutting and welding by any approved electric arc process. Any bending, forging, cutting or welding shall be carried out in such a manner as not to impair the strength in the metal. Forging shall be annealed as indicated in the drawing.

If drop forging through dies is resorted to, excessive forging in one operation shall be avoided. Where necessary, a series of intermediate stage dies shall be manufactured and used.

2.17 Welding

Welding of the bridge girders shall be done under strict supervision of the engineer. Approved procedures shall be followed. A brief of the same are given herewith:

2.17.1 Drawings and Procedure Sheets

The symbols for welding used on the fabrication drawings and procedure sheets shall be in accordance with IS: 813. If other symbols are used, a complete explanation of their meaning shall be given.

The fabrication drawings and/or welding procedure sheets prepared for direction of the welding organization shall include the following information:

a) Specification of the parent metal, and electrodes and/or wire-flux combinations.

b) Locations, sizes, actual lengths and details, i.e. form of joint, angle between fusion faces, gap between parts, etc., of all welds.

c) Whether welds are to be made in shop or field.

d) Welding procedure, like welding sequence, pre-heating, post heating etc.

e) Details of testing and inspection requirements.

2.17.2 Butt Welds

Forms and details: All details of butt-welded joints shall be in accordance with IS: 9595 and IS: 4353 as applicable.

Unsealed butt welds of single V, U, J and bevel types and incomplete penetration butt welds shall not be used. Sketches of different types of butt weld are given in Fig. No.-2 of the "SKETCHES" part of this specification. Intermittent butt welds shall not be used.

2.17.3 Sealing or backing

Single V, U, J bevel or square butt welds shall generally be completed by depositing a sealing run of weld metal on the back of the joints.

Where it is not practicable to deposit a run of weld metal on the back of the joint, then single V, bevel or square butt welds, welded from one side only, may be permitted, provided that another steel part of the structure or a special steel backing strip is in contact with the back of the joint and the edges of the steel parts of the joint are prepared as specified in IS: 9595 or IS: 4353, whichever is applicable, to ensure complete fusion of the parts to be joined.

In all full penetration butt welds which are to be welded from both sides, the back of the first run shall be gauged out by suitable means to clean sound metal, before welding is started on the gauged outside (see Fig. 3 of the "SKETCHES" part of this specification).

2.17.4 Butt welding parts of unequal cross-section

In butt welding steel parts in line with each other which are intended to withstand dynamic forces, and which are of unequal width, or where the difference in thickness of the parts exceeds 25% of the thickness of the thinner part or 3 mm whichever is greater, the dimensions of the wider or thicker parts shall be reduced at the butt joints to those of the smaller part, the slope being not steeper than 1 in 5 (see Fig. 4 of the "SKETCHES" part of this specification). Where the difference in thickness of the parts does not exceed 25% of the thickness of the thinner part or 3 mm whichever is greater, the transition of thickness shall be accomplished by sloping weld faces (see Fig. 5 of the "SKETCHES" part of this specification) by chamfering the thicker part or by combination of the two methods (see Fig. 6 of the "SKETCHES" part of this specification), at an angle not steeper than 1 in 5.

Where the reduction of the dimensions of the thicker part is impracticable, and/or where structures are not designed to withstand dynamic forces, the weld metal shall be built up at the junction with the thicker part to dimension at-least 25% greater than those of the thinner part, or alternatively, to the dimensions of the thicker member (see Fig. 7 of the "SKETCHES" part of this specification).

2.17.5 Butt welded T joints

Butt weld in T joint shall be reinforced by welding as shown in Fig. 8 of the "SKETCHES" part of this specification. Flange to web connection will also fall under this category.

2.17.6 Ends of butt welds

The ends of butt joint shall be welded so as to provide the full throat thickness. This shall be

done, in all cases of parent metal more than 20 mm thick and preferably in other cases also, by extending the ends of the butt welds past the edges of the parts joined by the use of run-on and run-off plates with a similar joint preparation and of reasonable thickness not less than the thickness of the part joined and of the length not less than 40 mm (see Fig. 9 of the "SKETCHES" part of this specification) If run on and run off plates are removed after completion of the welds, the ends of the weldshall be finished smooth and flush with the edges of the abutting parts. Run on and runoff plates are to be removed after completion of welds by abrasive cut off or by hacksaw blade. To avoid thermal stress as well as heat affected zone, Oxy-acetylene cut should not be permitted. If the parent metal is not more than 20 mm thick, the ends of the butt welds may be chipped or cut back to sound metal and then filled up with welds having a width not less than one and half time the 'V' opening and having the same reinforcement as adopted for the faces of the butt weld (see Fig. 10 of the "SKETCHES" part of this specification).

2.17.7 Reinforcement of butt welds

Sufficient convexity not exceeding 3 mm, shall be provided as reinforcement to ensure full cross sectional area at the joint. Where a flush surface is required, the butt welds shall be first built up as specified above and then dressed flush.

2.17.8 Fillet Welds: Types of fillet welds

Normal fillet weld - A normal fillet weld is one in which the depth of penetration beyond the root is less than 2.4 mm (see Fig. 11 of the "SKETCHES" part of thisspecification).

Deep penetration fillet weld: A deep penetration fillet weld is one in which thedepth of penetration beyond the root is 2.4 mm or more (see Fig. 11 of the "SKETCHES" part of this specification). It shall be used only by agreement between purchaser and contractor, and tests shall be agreed between purchaser and contractor to verify that the requisite route penetration is being obtained.

Table-1 Minimum size of first run of a fillet weld

Thickness of thickerpart	Minimumsize
6 mm up to and including20 mm	5 mm.
Over 20 mm up to andincluding 32 mm	6 mm.
Over 32 mm up to andincluding 50 mm	8 mm.

Table-2 Minimum size of a fillet weld

Thickness of thicker part	**Minimumsize**
Up to and including 6 mm	3 mm
Over 6mm up to andincluding 12 mm	4 mm
Over 12mm up to and including 18 mm	6 mm
Over 18mm up to and including 36 mm	8 mm
Over 36 mm up to andincluding56 mm	10 mm
Over 56 mm up to andincluding 150 mm	12 mm
Over 150 mm	16 mm

Notes:

i- When the minimum size of the first run of fillet weld and /or minimum size of the fillet weld as given in Table-1 and Table-2 is greater than the thickness of the thinner part, the minimum size of the weld shall be equal to the thickness of the thinner part. The thicker part shall be adequately pre-heated to prevent cracking of the weld.

ii- Where the thicker part is more than 50 mm in case of steel to IS: 2062 special precautions like pre-heating as per IS: 9595 shall be taken to ensure weld soundness.

2.17.9 Angle between fusion faces:

Fillet weld shall not be used for connecting parts, whose fusion faces form an angle of more than 1200 or less than 600, unless such welds are demonstrated by practical tests to develop the required strength.

2.17.10 Intermittent fillet welds:

Intermittent fillet welds may be used in structures not subjected to dynamic loading, to transfer calculated stress across a joint when the strength required is less than that developed by a continuous fillet weld of the smallest allowable size for the thickness of the parts joined.

Load carrying intermittent fillet welds shall not be used in members subjected to dynamic loading, except for connecting intermediate stiffeners to webs of beams and girders, subject to the provisions of "intermediate stiffeners" contained in this 23.5 specification.

Intermittent fillet welds shall not be used where they would result in the formation of rust pockets.

Chain intermittent welding is to be preferred to stagger intermittent welding.

The distance along an edge of a part between effective lengths of consecutive intermittent fillet welds, whether the welds are in line or staggered on alternate sides of the edge, shall not exceed 12 times the thickness of the thinner part and shall in no case exceed 150 mm. This requirement shall not be taken into account in complying with the requirements of

clauses 6.4 and 6.8 of IRS Steel Bridge Code. In a line of intermittent fillet welds, there shall be a weld at both ends of the parts connected. For staggered welds, this shall apply to both sides.

In built up members in whose parts are connected by intermittent filled welds, continuous longitudinal fillet welds shall be used at the end for a length not less than the width of the part concerned.

2.17.11 Fillet welds applied to the edge of a plate or section:

Where a fillet weld is applied to the square edge of a part, the specified size of the weldshall generally be at-least 1.5 mm less than the edge thickness, in order to avoid melting down of the outer corner, (see Fig. 14 of "SKETCHES" part of this specification).

Where a fillet welds is applied to the rounded toe of a rolled section, the specified size of the weld shall generally not exceed 3/4 of the thickness of the section at the toe(see Fig. 14 of "SKETCHES" part of this specification).

Where a fillet weld equal in size to the thickness of the section at the toe of a rolled section or at the square edge of a plate is required from design considerations and is specially designated in the drawing, the toe or edge shall be specially built up with weld metal in such a manner as to ensure full throat thickness, full fusion area and no injury to the parent metal (see Fig. 15 & 16 of "SKETCHES" part of this specification).

2.17.12 End Fillet:

When end fillets are used alone, each fillet shall be returned as a side fillet for a minimum length equal to twice the size of the weld, and this returned length shall be disregarded in calculating the strength of the joint.

2.17.13 Fillet welds in slots or holes:

When welding inside a slot or a hole, in a plate or other part, in order to join the same to an underlying part, fillet welding may be used along the wall or walls of the slot or the hole, but the later shall not be filled with weld metal or partially filled in such a manner as to form a direct weld metal connection between opposite wall. The dimensions of the slot or hole shall comply with the following limits in terms of the thickness of the steel part in which the slot or hole is formed.

2.0 The width or diameter to be not less than three times the thickness or 25 mm whichever is greater.

3.0 Corners at the enclosed ends of slots to be rounded with a radius not less than 1.5 times the thickness or 12 mm whichever is greater.

4.0 The distance between the edge of the part and edge of the slot or hole or between adjacent slots and/ or holes not to be less than twice the thickness when measured along the direction of stress and five times the thickness when measured normal to the direction of stress.26.8 End Returns:

Fillet welds terminating at the ends or sides of parts or members shall be returned continuously around the corner for a distance of not less than twice the size of the weld. This provision shall apply particularly to side and end fillet welds joining brackets, beam

seating and similar attachments at the tension side of such connections.

2.18 Preparation of Joint Faces:

Preparation of joint faces shall be done as per IS: 9595.

2.18.1 Fusion faces:

The preparation of fusion faces, angle of preparation root radius and root face shall be as specified in IS: 9595 and IS: 4353. Where the gap between the root faces of a butt joint is excessive, the gap shall not be bridged since this procedure often leads to cracking. The fusion faces of the joint shall be built-up with weld metal to give the appropriate gap before the weld proper is commenced.

The preparation of fusion faces, angle of bevel, root radius and root face shall be such that the limits of accuracy required by the appropriate application standard can be achieved. When however, no appropriate application standard exists and this standard is itself to be used, it is recommended that, for manual welding, the tolerances on limits of gap and root face should be ±1 mm on the specified dimensions for material up to and including 12 mm thick and ±2 mm for material over 12 mm thick. The tolerance on the included angle between the fusion faces of a V preparation is recommended to be ±5 degree and for U and J preparations + 10 degree. For an automatic process, closer limits are necessary and particular requirements depend on the characteristics of the process.

It shall be ensured, if necessary, by suitable non-destructive tests that the fusion faces and adjacent surfaces shall be free from cracks, notches or other irregularities which might be the cause of defects or would interfere with the deposition of the weld.

Fusion faces and the surrounding surfaces shall be free from heavy scale, moisture, oil, paint or any other substance which might affect the quality of the weld or impede the progress of welding. Certain proprietary protective coatings are specially formulated with the intention that they should not interfere with welding. The use of such coatings is not excluded by the requirements of this clause but shall be demonstrated by means of specimen welds that the coating complies with the above requirements.

2.18.2 Assembly for Welding:

Parts to be welded shall be assembled such that the joints are easily accessible and visible to the operator.

Jigs and manipulators shall be used, where practicable, so that the welding can be carried out in the most suitable position. Jigs shall maintain the alignment with the minimum restraint so as to reduce the possibility of locked in-stress.

2.18.3 Sequence of welding and weld pass for composite girders, shear connectors etc.:

For fabrication of welded composite girders, channel shear connectors shall be welded on top flange plate prior to assembly of I-section. This facilitates correction of any distortion of flange plate developed during the welding of channel shear connectors.

In making a typical I-section four fillet welds are to be made. The welding sequence to be

followed is indicated by number 1 to 4 as shown in the Fig. No.-23.

Whenever a square butt weld in a 10 or 12mm thick plate is required to be made, the sequence to be adopted is shown in Fig. No.-23.

2.18.4 Welding in solid web girders:

Flange Plates: Each flange shall, as far as possible, particularly in dynamically loaded structures, consist of a single section rather than of two or more sections super- imposed. The single section may comprise a series of sections laid end to end and effectively welded at their junctions.

If the use of curtailed flange plates cannot be avoided the end of the plate shall be tapered in plane to a rounded end and welded continuously round the end.

In dynamically loaded structures, flange plates laid end to end shall be joined by butt welds, and welded cover plates shall not be used. Joints in flange plates shall be butt welded and dressed flush before assembling.

Where the flange consists of more than one section, the butt joints shall be staggered.

Welded cover plates, where used in structures not subjected to dynamic loading, shall have enough welds on either side to develop the load 5% more than that of the element spliced.

The flange plate, welded directly to the web plate, shall not be more than 50 mm thick when steel conforms to IS: 2062.

Web Plates: Splices in the webs of plate girders and rolled sections used, as beams shall be made by butt welds dressed flush on all faces, in the case of dynamically loaded structures. In the case of structures not subjected to dynamic loading, splice plates may be used independently and not to reinforce a butt-welded splice.

Intermediate stiffeners:

Where intermediate stiffeners are connected to the web by intermittent fillet welds placed in pairs, one weld on either side of the stiffeners, the effective length of each weld shall be not less than four times the thickness of the stiffeners.

Where staggered intermittent fillet welds are used, the effective length of each weld shall be not less than 10 times the thickness of the stiffener.

Fillet welds placed on one side only of the stiffener shall not be used.

Intermediate stiffeners carrying cross bracings or diaphragms shall not be connected to the web by intermittent fillet welds. Intermediate stiffeners shall be located away from web splices.

2.19 Safety Precautions

Provisions of IS: 818, IS: 1179 and IS: 3016 shall generally apply for safety and health requirements during welding operations.

2.20 Approval and Testing of Welding Procedures

Welding procedure test shall be carried out in accordance with IS: 7307(Part-I) to

demonstrate, by means of a specimen weld of adequate length on a steel representative of that to be used, so as to confirm that satisfactory weld is achievable with the welding procedure to be used for fabrication.

Provisions of IS: 9595 and IS: 4353, shall generally be followed, as applicable, for welding procedure, details of workmanship, correction of weld faults, peening, painting, etc. In case any of the provisions contained therein contravene the provisions made on this code, the latter shall be followed.

In addition to the provisions of IS: 4353 the Inspector may, where deemed necessary, require a sample joint having the same cross-section as the joint to be used in construction and a length of at least 300 mm to be welded with the wire, flux current, arc voltage and speed of travel that are proposed to be used and a macro etched cross section of the welded joint prepared as a demonstration that the specified requirements will be met, when the welding current, arc voltage and speed of travel are established by a test made in accordance with requirements of this clause, they shall be kept within the following limits of variations.

Welding current	: ±10%
Arc Voltage	: ± 7%
Speed of travel	: ±15%.

2.21 Approval and Testing of Welders

The welders shall be trained in accordance with IS: 817. The welders shall be subjected to appropriate qualifying tests specified in IS: 7310 (Pt-I).

2.22 Welding Processes and Procedures:

Welding work shall be given to a contractor who does produce satisfactory evidence of his ability to handle the work in a competent manner. The contractor shall also prove the ability of the operator/Welders employed by him to produce welds of the required strength. The contractor shall employ a competent welding supervisor to ensure that quality of materials and the standard of workmanship comply with the requirements laid down in this code.

The sizes and length of welds shall not be less than those specified in the drawings nor shall they be substantially in excess of the requirements without prior approval of the Engineer. The location of welds shall not be changed without prior approval of the Engineer. Welds shall preferably be made in flat position.

In case of welds in structures subjected to dynamic loading, adequate means of identification, either by identification stamp or other records shall be provided to enable each weld to be traced to the welding operator by whom it was made. During the entire welding of cooling cycle, the joints shall not be subjected to any external forces or shocks.
Freedom of movement of one member of a joint shall be allowed wherever possible. No butt joint shall be welded without allowing one component, freedom of movement of the order of 1.5 mm. In making welds under conditions of severe external shrinkage restraint, the welding shall be carried out with electrodes having type 6 covering as per IRS:M-28 Specification. In case of welding using direct current, earthing on the work piece to be welded shall be connected carefully at more than one location with a view to avoid “Arc Blow” during welding.

All welds should be done by submerged arc welding process either fully automatic or semi-automatic. Carbon-di–oxide (CO_2) welding or manual metal arc welding may be done only for welds of very short runs or of minor importance or where access of the locations of weld does not permit automatic or semi-automatic welding.

Neither the depth of fusion nor the maximum width in the cross section of weld metal deposited in each weld pass shall exceed the width of the face of the weld pass.

All welds should be done by submerged-arc welding process either fully automatic or semi-automatic. Carbon di oxide welding or manual metal-arc welding may be done only for welds of very short runs or of minor importance or where access of the locations of weld do not permit automatic or semi-automatic welding.

Except for special types of edge preparation, such as single and double 'U' single and double 'J' the fusion edges of all the plates which are to be joined by welding may be prepared by using mechanically controlled automatic flame cutting equipment and then ground to a smooth finish. Special edge preparation should be made by machining or gouging.
The welding procedure shall be such as to avoid distortion and minimize residual shrinkage stresses. Properly designed jigs should be used for assembly. The welding techniques and sequence, quality, size of electrodes, voltage and current required shall be as prescribed by manufacturers of the material and welding equipment. The Contractor should submit full details of welding procedure in proforma given at Appendix V of IRS B-1-2001 specification, copy of which is available in "Maintenanceof Records" of this specification.

Site welding should not be undertaken except in special circumstances with the approval of the Engineer. Site welding should be confined to connections having low stresses, secondary members, bracings etc.

Manual metal arc welding may be done taking adequate precautions as per IS: 9595 and under strict supervision.

2.23 Sequence of Welding

The sequence of welding shall be such that when possible the members, which offer the greatest resistance to compression, are welded first.

The welding in the thinnest element of a section (usually the web in case of beams) shall be done prior to the welding of the thicker elements (usually the flanges in caseof beams).

In making butt welded joints in rolled shapes, the sequence and procedure of welding shall take into account unequal amount of expansion or contraction in elements being welded.
Splices in each component part of a solid web girder or built-up member shall be made before such component part is welded to other component part of the member.

2.24 Position of Welding:

For fabrication of steel bridge girders, the following positions of welding shall be adopted.

I) Flat and horizontal position for Submerged Arc Welding (SAW) and

II) Horizontal or horizontal-vertical position for welding done using manual metal Arc welding (MMAW) or CO_2 welding.

All butt welds by the submerged arc process shall be made in the flat position. Fillet welds may be made in either flat or horizontal-vertical position. The size of the single pass fillet welds made in the horizontal-vertical position shall not exceed 8 mm.

2.25 Tack Welds:

Tack welds shall be not less than the throat thickness or leg length of the root run to be used in the joint. The length of the tack weld shall not be less than four times the thickness of the thicker part or 50 mm whichever is the smaller

Where a tack weld is incorporated in a welded joint, the shape, size and quality shall be suitable for incorporation in the finished weld and it shall be free from all cracks and other welding defects. Tack welds, which are prone to cracking, shall be cut out and re welded.

Tack welds shall not be made at extreme ends of joints.

2.26 Inter-run Cleaning:

Each run of weld bead shall be thoroughly cleaned to remove particles of slag, spatters, etc. before the subsequent bead is super-imposed during multi-pass welding. Similarly, each layer of weld should be thoroughly cleaned of slag, spatters, etc. before depositing subsequent layers of weld with particular reference to thorough cleaning of toes of the welds. Visible defects, such as cracks, cavities and other deposition faults, if any, shall be removed to sound metal before depositing subsequent run or layer of weld.

2.27 Stray arcing on Work:

Stray arcing shall be avoided as this can leave local hard spots or cracking which are to be removed by mechanical means and be checked by inspection depending upon the application.

2.28 Inspection and Testing of Welded Joints:

The inspection of bridge girders shall be done by RDSO. The Inspector designated by the purchaser shall ascertain that fabrication by welding is performed in accordance with the requirements of this code. Inspection of welds shall also be carried out in accordance with this Code. For the provisions, which are not incorporated in this Code, IS: 822 "Code of procedure for inspection of welds" shall be followed.

He shall be furnished with complete detailed drawings showing the size, length, type and location of all welds, which are required to be made. He shall be notified in advance of the start of any welding operations. He shall have free access to the work being done at all reasonable times by the contractor and facilities shall be provided so that during the course of welding he may be able to inspect any layer of weld metal. He shall be at liberty to reject any material that does not conform to the provisions of this code and to require any defective welds to be removed and re-welded.

2.29 Inspection prior to welding:

2.29.1Parent metal:

All plates and sections shall be inspected in the contractor's works before fabrication. Verification of the quality of parent metal shall be carried out by reference to the relevant test certificate. The Inspector may, at his discretion, ask for spot checks to be made on the chemical composition and physical properties of the material. Freedom from harmful defects such as cracks, surface flaws, laminations, and rough, jagged or imperfect edges shall be verified by visual examination of the material prior to welding. Dimensions of parts shall be checked by measurement.

2.29.2Edge preparation and set-up of parts:

Edge preparation shall conform to the relevant drawings and meet the requirements of this code.

After the parts are assembled in position for welding, the Inspector shall check for incorrect root gap, improper edge preparation and other features that might affect the quality of the welded joint.

2.29.3Verification of operator's qualification:

Welding shall be permitted to be performed only by welders and welding operators who are qualified in accordance to the "Approval and Testing of Welders" contained in this specification. The Contractor shall, if so required, prescribe the welding procedure to be followed. Before any welding on the actual job is allowed under the contract, the Inspector shall verify, in accordance with the provisions of IS: 9595 and IS: 4353 as applicable, that the procedure prescribed is satisfactory.

2.30 Inspection after Welding:

For visual inspection of defects, the weld surface shall be thoroughly cleaned of oxide layers and adherent slag. If chipping hammer is used to remove slag, care shall betaken to see that hammer marks do not obscure the evidence of fine cracks. Brushing with a stiff wire-brush or grit blasting shall normally be followed. Welding profile -The finished welds shall be visually inspected and shall conform to the size and contour specified in the drawings (Acceptable and defective weld profiles are illustrated in Fig. 17 to 21 of the "SKETCHES" part of this specification). Conformity of fillet welds as to size and contour shall be determined by the use of gauges as per Figure No.-22 of "SKETCHE" part of this specification. Concavity and excessive convexity of fillet welds shall be marked for correction.

2.31 **Acceptance levels for Quality of Welds**:

Welds shall meet acceptance levels as per Table No.-3 of "QUALITY CONTROL" part of this specification.

2.31.1Dimensional check:

The weldment shall be inspected for dimensional accuracy (including warpage) and shall be within the tolerances specified.

2.32 Non-destructive tests:

2.32.1 Radiographic tests:

Butt welds shall be examined by radiographic test, which will present satisfactory evidence to the Inspector that welds are meeting the quality requirements. Other welds may be examined by radiographic or any other non-destructive method, which are equally effective. Welds shall also be examined by liquid penetrant flaw detection method or by magnetic particle flaw detection method as per IS: 3658 and IS: 3703.

2.33 Marking of Defective Welds:

The marking shall be positive and clear and in accordance with the method of marking followed and understood by the Inspector and shop personnel involved in making the repairs. Marking shall be permanent enough to be evident until the repair is carried out and the inspection completed. After the repair has been done, it shall be inspected again and properly marked to indicate whether the repair is satisfactory or not.

2.34 Bolts, Nuts and Washers

Bolts, Nuts and Washers shall be in accordance with the following specifications:
Black hexagonal bolts to IS: 6639 and Nuts to IS: 1363.

Precision and turned bolts with nuts and hexagonal screws to IS: 1364. Plain

washers to IS: 2016 and IS: 5369.

Spring washers - IS: 3063.

Taper washers - IS: 5372 and IS: 5374.

Manufacture, workmanship, Marking, packing etc. for Bolts and Nuts shall comply with the requirements of IS: 1367.

Where the head and nuts bear on timber, square washers having the length of each side not less than three diameters of the bolt and the thickness not less than one quarter of the diameter shall be provided. Steel, wrought iron or malleable cast iron taper washers shall also be provided for al heads and nuts bearing on beveled surfaces.

For black bolts a clearance (difference in diameter) of 1.5mm for all sizes of bolts shall be allowed.

Where turned bolts are required they shall be carefully turned and shall be parallel throughout the barrel. Holes for turned bolts should be 1mm under drilled in shop and should be reamed at site to suit the diameter of the turned bolts.

The following limits of tolerances shall be permitted upon the diameter of the shank of turned bolts and of the holes which they are to fit:

Limit of tolerance	Shank of bolt (mm)	Hole(mm)
High	0.000	+0.125
Low	- 0.125	0.000

The shank of each turned bolt shall be of such a length that it is in full contact with the

work, throughout, the screwed portion being made at least 1.5mm less in diameter than the shank or to suit the next smaller size of screw thread. The shank portion shall be joined to the threaded portion by a 45^0 chamfer within the thickness of the washer. Washers with perfectly flat faces should be provided with all turned bolts.

The washers under the nut shall have a hole of 1.5mm larger in diameter than the shank of the bolt and shall have a thickness of not less than 6mm so that the nut, when screwed up, shall not bear on the shoulder of the bolt.

2.35 Connecting Pins:

All connecting pins shall be finished accurately to gauge and parallel throughout, straight and with smooth surface entirely free from flaws and of sufficient length to ensure that all parts connected thereby shall have a full bearing on the pin. They shall be turned to a smaller diameter at the end for the thread and driven to place with a pilot nut, where necessary to preserve the thread.

2.36 Pin Holes:

Pinholes shall be bored smooth straight and true to gauge and at right angles to the axis of the member. Boring shall only be done after the member has been rivetted up and the diameter of the pin shall not be less than that of the hole by more than 0.5mm.

2.37 Bearing and Expansion gear

All steel bed and bearing plates or plates over saddle castings, shall be made perfectly level and all rivet heads on their bearing surfaces shall countersunk and dressed flush.
The saddles, knuckle-bearers and roller bed-plates shall be planed on all bearing surfaces and elsewhere as indicated on the Contract Drawings and all bolt-holes shall be drilled. The bottom edge of ribs should be machined and welded to the bottom slabs after which the top edges of the ribs should be machined as a whole and the top plate welded. Subsequently the top and bottom surfaces should be machined to the specified tolerances as given in Appendix VI of B1 specification. Generally, in connection with the bearing gear all meeting surfaces including the sides of the roller frames, shall be machined, all bolts except anchor bolts turned and fitted, all washers faced, the rollers knuckle and pins polished to smooth surface and the whole finished in the style of first class machined work.

Tolerances shall be as specified in Appendix VI of IRS B-1-2001 specification and shall be shown on the drawings.

2.38 Erection in Contractor's Works:

The work shall be temporarily erected complete at the Contractor's Works for inspection by the Inspecting Officer, with the exception of such rivetting as has to be done at site, so that accuracy of fit and perfection of workmanship may be assured. The work shall be put together with sufficient numbers of parallel drifts or turned bolts or both to bring the pieces into place. When so erected all holes left to be filled at site shall be so fair that a parallel gauge turned to a diameter 0.8mm less than that of the hole, of a length equal to the depth of the hole, can be passed through them without difficulty. No drift shall be used anywhere in the work larger in any part than the hole in which it is to be driven. Holes for turned bolts, which have been 1 mm-under drilled in shop, should be reamed at site by the erecting agency.

2.39 Interchangeability:

Every span is to be temporarily erected complete in Contractor's works adopting the method of giving camber and all parts as marked to their place, unless the whole of the work is made completely interchangeable by the use of steel jigs and hard steel bushes controlled by master gauges, in which case the first span must be completely erected to test the accuracy of the templates. Further spans or part span assemblies built from parts selected at random by the Inspecting Officer shall be erected from time to time to check the accuracy of the work as the Inspecting Officer may require. If the work is considered interchangeable by the Inspecting Officer a simplified scheme of marking will be permitted, i.e. all pieces that are identical shall bear one distinguishing mark irrespective of the span to which they belong. Should the interchangeability not to the satisfaction of the Inspecting Officer, the whole of the spans must be erected complete and all parts marked to their place without additional charge. The tenderers must state in their tenders whether they intend to adopt complete interchangeability or not. Under special arrangement with the Purchaser, it shall be permissible for approved portions of the work to be dispatched before complete erection of the first span, provided the Contractor satisfies the Inspecting Officer that such portions of the work are strictly interchangeable and will assemble correctly and accurately in the complete structure.

2.40 Camber

In order to ensure that the fabrication and erection of main girders shall be such as to eliminate secondary stresses in the loaded span, the nominal length (i.e. the lengths which will give no camber) of member shall be increased or decreased by the amount shown on the camber diagram supplied by the Purchaser. For setting of the angles of intersection of the chords and web members and also for templating the gusset, full size of panels with nominal lengths of the members, shall be used. Similarly, the machining of all chords butts shall be to suit the nominal outline as defined earlier.

The procedure for erecting the span at Contractor's work shall be as specified. The site rivetting holes shall be rivetted or bolted and drifted as specified in Appendix III of IRS B-1-2001 specification.

When supported on blocks or staging's, the girders shall be erected to the camber specified in the fabrication drawings according to which the girders have been manufactured. A camber diagram indicating the relevant height of each panel point when erected on blocks at the manufacturing works shall be supplied by the Engineer. The cambering of the main girders along with pre–stressing, when all panel points are supported on the blocks or staging's, shall be carried out in accordance with Appendix 'A' of Steel Bridge Code. Special methods of erection will require special erection drawings approved by the Engineer, which must not be deviated from.

In the case where the girders are erected on yielding supports such as a service span, due allowance shall be made for the anticipated yield when the camber blocks are set out.

Frequent checks shall be made of the camber of girders during erection and care taken to see that the camber as per drawing is obtained when the girder is completely assembled. When span is supported on ends and intermediate supports are removed the dead load camber shall be recorded and entered in bridge register. This will provide the reference to compare the

camber checked during technical inspection.

2.41 Testing

The Inspecting Officer shall be empowered, at his/her discretion to make or have made under the supervision, any of the tests specified in the specifications mentioned herein in addition to such other tests as he/she may consider necessary, at any time up to the completion of the contract and to such an extent as he/she may think necessary to determine the quality of all materials used therein. In doing so, he/she shall be at liberty under any reasonable procedure, he/she may think fit to select, identify, have cut-off and take possession of test pieces from the material either before, during or after its being worked up into the finished product.

He shall also be empowered to call for a duly authenticated series of mechanical tests to be obtained from the maker for these materials used in the work and to accept the same in lieu of other tests to the extent he/she deems fit. The Contractor shall supply the material required for the test pieces and shall also prepare the test pieces necessary.

The test shall be carried out by the Contractor, for which Contractor shall provide all facilities including supply of labour and plant. Inspecting officer may at his/her discretion direct the Contractor to dispatch such tests pieces as he/she may require to the National Test House or elsewhere as he/she may think fit for such testing purposes.

2.42 Check on Tests made at Contractor's work

The Inspecting Officer may at his/her discretion, check test results obtained at Contractor's work by independent tests at National Test House. The Inspecting Officer shall at all times be empowered to examine and check the working of the Contractor's plant before and after using it. Should the Contractor's plant be found, in the Inspecting Officer's opinion, unreliable, he/she is empowered to cancel any tests already carried out in this contract and have these tests carried out at any National Test House or elsewhere, as he/she may think fit.

2.43 Analysis

The Contractor shall supply authenticated copies of analysis of any materials used in the contract when required to do so by the Inspecting Officer who shall be empowered to accept them to the extent he/she thinks fit. In addition to the above samples may, at the Inspecting Officer's discretion be subjected to complete analysis at the National Test House or elsewhere as the Inspecting Officer may determine, the cost of the same to be borne by the Purchaser.

2.44 Inspection – general

The Inspecting Officer shall have free access to the works of the Contractor at all reasonable times and shall be at liberty to inspect the process of manufacture at any such time and to reject in whole or part, any work or material that does not conform to the provisions of this Specification and may order the same to be removed, replaced or altered at the expense of the Contractor. All gauges and templates necessary to satisfy the Inspecting Officer of the complete interchangeability of parts must be supplied by the Contractor free of cost.

3.0 Oiling, Painting, Metallizing of Girders, Packing and Dispatching

No part of the work shall be painted or coated, packed or dispatched, until it has been finally inspected and approved by the Inspecting Officer. Dry Film Thickness shall be measured by Eclometer or any other approved method.

When so specified by the Purchaser, the whole of the work except machined surfaces shall be given protective coating using one of the systems of painting or metallizing given herewith. Prior to the application of protective coating, the surface of work shall be carefully prepared removing mill-scale, rust, etc. using wire brushes, sand or grit blasting as stipulated and approved by the Purchaser.

Specifications for metallizing and painting of bridge girders shall be as per IRS B1- 2001. No painting work will be permitted during the monsoon period.

3.1 Surface Preparation (for all types of Painting and Metallizing)

Surface of all **components /members** of the superstructure shall be prepared as per following provisions before application of first coat of paint/primer or before metalizing.

(i) The surface should be clean, dry and free from contaminants and it should be rough enough to ensure adhesion of the paint film. However, it should not be so rough that the film cannot cover the surface peaks.

(ii) The cleaning of the surface shall be done initially with the use of emery paper, wire brushes, scrapers etc. for spot cleaning to remove rust, scale etc. Subsequently, sand blasting of the surface shall be done to remove rust, mill scale along with some of the base metal. This will be achieved by high velocity impact of abrasive material against the surface in accordance with the provisions of IS:6586, which will also create a base for good adhesion. The abrasive material once used for cleaning heavily contaminated surface should not be reused even though re-screened. Washed salt free angular silica sand of mesh size 12 to 30 with a minimum of 40% retained on a 20 mesh screen shall be used for blasting. The material specifications and other requirements shall be as provided in Indian Railways Bridge Manual, 1998 (with latest revision).

(iii) All site rivets, bolts, nuts and washers shall be thoroughly cleaned and dipped in boiled linseed oil. All machined surfaces are to be well coated with a mixture of white lead conforming to IS:34 and Mutton tallow conforming to IS:887 as per specifications before dispatch to site. Nothing extra shall be payable to contractor on this account.

3.2 Metalizing and Painting of Floor and Deck systems of the Bridge

(i) All the components in the floor and deck system in Steel girders of this Railway Bridge shall be metalized as per IRS specifications. Components to be metalized in rail deck are cross girders, stringers, connecting gussets and other components.

(ii) The sprayed coating shall be applied as soon as possible after surface preparation.

(iii) The wire method shall be used for the purpose of metallizing, the diameter of the wire

being 3mm or 5mm as per approved by Engineer. Specified thickness of coating shall be applied in multiple layers and in no case less than 2 passes of the metal spraying unit shall be made over every part of the surface. The surface after spraying shall be free from uncoated parts of lumps of loosely spattered metal.

(iv) The composition of the aluminum to be sprayed shall be in accordance with BS:1475, material 1-B (99.5%) aluminum otherwise as per IS:739 and IS:2590. However, the selection of metal for spraying, i.e. Zinc or Aluminum shall besubject to final approval by the Engineer.

(v) At least one layer of the coating must be applied within four hours of blasting andthe surface must be completely coated to the specified thickness within 8 hours of blasting.

(vi) Minimum thickness of metal coating applied shall be 115 microns and average thickness shall be 150 microns. The metal coating shall be checked for thickness by approved magnetic thickness measuring gauge. At least one reading for each sqm of area painted shall be taken. The calibration of the gauge shall be checked against a standard of similar thickness within an accuracy of 10 %.

(vii) For measurement of dry film thickness, following instruments may be used bythe contractor. Dry film thickness is to be measured as described in Appendix-VII of IRS BI-2001.
(a) Electronic coating thickness gauge.
(b) Elcometer (magnetic thickness gauge) Dial type.
(c) Surface profile gauge.

(viii) Any oil, grease or other contamination should be removed by thorough washing with a suitable thinner until no visible traces exist and the surfaces should be allowed to dry thoroughly before application of paint. The coatings may be applied by brush or spray. If sprayed, pressure type spray guns must be used. One coat of wash primer to IS: 5666 shall be applied first. After 4 to 6 hours orthe application of the wash primer, one coat of Zinc chrome primer to IS: 104 with the additional provision that zinc chrome to be used in the manufacture of primer shall conform to type 2 of IS:51 shall be applied.

(ix) The third coat shall be by Aluminum paint conforming to IS:2339. The girder parts shall be dispatched to site after the third coat (i.e. first finishing coat or cover coat).

(x) After assembling and launching at site, second finishing coat of Aluminium paint conforming to IS:2339 shall be applied after touching up the primer and first finishing coat.

3.3 Painting of other components of this bridge (other than those in floor and deck systems)

Protective coatings by paintings as per following painting schedule may be applied with the approval of the Engineer:

a) Primer coat: Two coats of ready mixed paint red lead primer to IS:102.

Or

One coat of ready mixed zinc chrome primer to IS:104 followed by one coat ofzinc chrome red oxide primer to IS:2074.

b) Finishing Coat: Two coats of aluminium paint to IS:2339 shall be applied over the primer coats. One coat shall be applied before the fabricated steel work leavesthe shop. After the steel work is erected at site, the second coat shall be applied after touching up the primer and the finishing coat if damaged in transit.

3.4 Miscellaneous

(i) Final dry film thickness in case of metallizing shall be average 150 microns and shall be measured before application of final finishing two coats.

(ii) Surface preparation shall not be done unless approved paints of sufficient quantity (both primer and finishing) are available in stock.

(iii) Special care should be taken in preparing corners, junctions of members, head and nuts of bolts, rivets, holes, areas less accessible, hidden pockets etc. Surface preparation at such locations shall not be inferior to that attained over the rest of the area.

(iv) Surface preparation shall not be carried out in the following conditions:
- In rainy season from June to September and from December to January.
- In extremely windy/misty/dust blowing conditions.
- At night
- In winter before 8 A.M.
- In summer between 11 and 15 hrs, in areas, which are likely to be exposed to direct sunlight.

Engineer reserves the right to change the above timings.

Final dry film thickness in case of metallizing as well epoxy painting shall be average 150 microns and shall be measured before application of final finishing coats.

Surface preparation shall not be done unless approved paints of sufficient quantity (both primer and finishing) are available in stock.

Special care should be taken in preparing corners, junctions of members, head andnuts of bolts, rivets, holes, areas less accessible, hidden pockets, etc. Surface preparation at such locations shall not be inferior to that attained over the rest of the area.

Surface preparation shall not be carried out in the following conditions:

B. In rainy season from June to September and from December to January.
C. In extremely windy/misty/dust blowing conditions
D. At night
E. In winter before 8 A.M.
F. In summer between 11 and 15 hours, in areas, which are likely to be exposed to direct sunlight.

3.4.1 **Inspection**

Adhesion: The sprayed metal coating shall be subjected to an adhesion test using the method described in IRS B1-2001if any part of the coating between the lines breaks away from the base metal; it shall be deemed to have failed the test.

Articles that have been rejected shall have the defective sections blasted clean off all sprayed material prior to re-spraying. Where the rejection has been solely due to too thin a coating, sprayed metal of the same quality may be added provided that the surface has been kept dry and is free from visible contamination.

3.5 Paints: Source & Quality:

Paint and other accessories including those for metallizing for the work will be supplied by the contractor. Paints manufactured by the following firms (or more) maybe used subject to their bearing in the approved list of RDSO and final approval by Engineer-in-charge.

1. M/s. British / Burger paints
2. M/s. Johnson & Nicholson
3. M/s. Shalimar paints
4. M/s. I.C.I.
5. M/s. Nerolac.

The contractor shall furnish to BBMP / Railways, the date of manufacture of paint as certified by the manufacturers with the necessary container marking and test certificate for paint conforming to relevant IS code. In addition to this, he shall also submit the necessary vouchers in respect of paint purchased by him.

BBMP / Railways reserves the right to get the paint tested at contractor's expenses as considered necessary by BBMP/Railways. If the test results do not conform to relevant IS specifications fully, then the lot of paint shall be rejected and got removed from the contractor(s) storage. If the paint has already been applied it shall be removed.
In addition to above, the following tests are required to be carried out in the field:

i. Weight per litre.

ii Consistency test.

iii. Scratch test.

iv. Flexibility and adhesive test.

Note – BBMP / Railways *reserves the right to reject the lot of paint even on the basis of field results.*

3.5.1 **Painting – General Instructions**

Painting shall not be commenced till the surface preparation has been approved by the Engineer or his representative or inspecting officer.

Sealed containers of paint of approved brand shall be used. The paint drums must be rolled, turned upside down and shaken before opening. The paint must be stirred well before use. Over stirring which results in invisible air bubbles etc., shall be avoided.

Where brush painting is accepted, the paint must be applied by means of flat brushes not more than 75mm in width having soft flexible bristles conforming to IS: 384.

Round and oval brushes of approved quality conforming to IS: 487 may also be used as per the instructions of the Engineer or his representative or inspecting officer.

All new bushes should be soaked in raw linseed oil conforming to IS: 77 for at least 24 hours before use.

A little blue paint shall be added, in the first coat of aluminium paint to distinguish it from second coat. For paints of other colours for final and finishing two coats, suitable pigment shall be used as per instruction of the Engineer, to distinguish the first coat from the second coat.

The date of painting shall be marked with paint on the member.

3.6 Care During Painting

Paint should be mixed in small quantities sufficient to be consumed within one hour in the case of red lead paint.

The applied coat of paint shall be uniform, and free from brush marks, sack marks, blemishes, scratching, non-uniform thickness, holes, log marks, fuel staining, cracking, scaling, and other defects.

Paint shall be applied only on dry and clean surface free from moisture or dust (including scrapping dust).

Paint should be used within the prescribed shelf life from the date of manufacture.

Each coat of paint shall be left dry till it sufficiently hardens before the subsequentcoat is applied. Each coat of paint shall be inspected by the engineer or inspecting officer and certified as satisfactory before applying subsequent coat.

The payment for complete painting of all components of girders including all accessories, painting of contact surface etc. including all labour and material, is included in the accepted rates for item in the schedule of items, rates and quantities and nothing extra shall be paid.

3.7 Specification for Metallizing with Sprayed Aluminium for Bridge Girders

3.7.1 Surface Preparation:

The surface shall be thoroughly cleaned and roughened by compressed air blasting or centrifugal blasting with a suitable abrasive material in accordance with Clause 3 of IS: 6586. Immediately, before spraying it shall be free from grease, scale, rust, moisture orother foreign matter. It shall be comparable in roughness with a reference surface produced in accordance with appendix A of IS: 5905 and shall provide an adequate key for the subsequently sprayed metal coating.

3.7.2 Metal Spraying

The metal spraying shall be carried out as soon as possible after surface preparation but in any case within such period that the surface is still completely clean, dry and without visible

oxidation. If deterioration in the surface to be coated is observed by comparison with a freshly prepared metal surface of similar quality which has undergone the same preparation, the preparation treatment should be repeated on thesurface to be coated.

The wire method shall be used for the purpose of metallizing the diameter of the wire being 3mm or 5mm. Specified thickness of coating shall be applied in multiple layers and in no case less than 2 passes of the metal spraying unit shall be made over every part of the surface. At least one layer of the coating must be applied within 4 hours of blasting and the surface must be completely coated to the specified thickness within 8 hours of blasting.

i- **Purity of Aluminium:**

The chemical composition of aluminium to be sprayed shall be 99.5% aluminium conforming to IS: 2590.

ii- **Appearance of the coating:**

The surface of the sprayed coating shall be of uniform texture and free from lumps, coarse areas and loosely adherent particles.

iii- **Thickness of the coating:**

The nominal thickness of the coating shall be 150 µ (microns). The minimum local thickness, determined in accordance with procedure given below, shall be not less than 110 µ (microns).

3.7.3 **Shop Painting:**

Any oil, grease or other contamination should be removed by thorough washing with a suitable thinner until no visible traces exist and the surfaces should be allowed to dry thoroughly before application of paint. The coatings may be applied by brush or spray. If sprayed, pressure type spray guns must be used. One coat of wash primer to IS: 5666 shall be applied first. After 4 to 6 hours of the application of the wash primer, one coat of Zinc chrome primer to IS: 104 with the additional proviso that zinc chrome to be used in the manufacture of primer shall conform to type 2 of IS: 51 shall be applied.

After hard drying of zinc chrome primer, one coat of Aluminum paint to IS: 2339 (brushing or spraying as required) shall be applied.

3.7.4 **Site Painting:**

After the steel work is erected at site a second cover coat of Aluminium paint to IS:2339 (brushing or spraying as required) shall be applied after touching up the primer and the cover coat given in the shop if damaged in transit.

3.7.5 **Method for the Determination of Local Thickness**

Equipment:

Any magnetic or electro-magnetic thickness meter that will measure local thicknessof a known standard with an accuracy of ± 10 percent.

Calibration of Instrument
Calibrate and check the meter on one of the following standards (as appropriate):

(I) (Applicable to magnetic and electro - magnetic meters other than the pull-off type) A

soft brass shim, free from burrs, in contact with the grit-blasted surface of the base metal prior to its being sprayed. The thickness of the' shim shall be measured by micro meter and shall be approximately the same as the thickness of the coating.

(ii) A sprayed metal coating of uniform known thickness approximately the same as the thickness of the sprayed coating to be tested, applied to a base of similar composition and thickness to the article being sprayed, grit-blasted in accordance with Clause 1.

Procedure:

For each measurement of local thickness, make an appropriate number of determinations, according to the type of instrument used. With instrument measuring the average thickness over an area of not less than 0.645 cm^2, the local thickness shall be the result of the one reading.

With instruments having one or more pointed or rounded probes, the local thickness shall be the mean of three readings within a circle of 0.645 cm^2 area.

With meters having two such probes, each reading shall be the average of two determinations with the probes reversed position.

3.7.6 **Method of Test for Adhesion**

Using a straight edge and hardened steel scriber which has been ground to a sharp 30 degree point scribe two parallel lines at a distance apart equal to approximately 10 times the average coating thickness. In scribing the two lines, apply enough pressure on each occasion to cut through the coating to the base metal in a single stroke.

3.7.7 **Inspection:**

Determination of Local Thickness

The minimum local thickness shall be determined by the method described above.

Adhesion

The sprayed metal coating shall be subjected to an adhesion test using the method described above. If any part of the coating between the lines breaks away from the base metal, it shall be deemed to have failed the test.

Articles, which have been rejected, shall have the defective sections blasted clean of all sprayed metal prior to repaying. Where the rejection has been solely due to too thin a coating, sprayed metal of the same quality may be added provided that the surface has been kept dry and is free from visible contamination.

The erection rate is to include the supply of all site rivets, turned and black Bolts, nuts, washers etc. required to complete erection at site as per relevant codes & practices.

3.8 Name Plate

A neat casting bearing the name of the Contractor, the place and year of manufacture, drawing number, the contract number and the standard of loading to be specified by the Purchaser shall be bolted conspicuously on each span. The drawing of the name plate shall be approved by the Engineer.

3.9 Erection Mark

Every portion of the work shall be distinctly stenciled with paint with letter size not less than 10 mm for guidance in the erection in the field, and stamped with the letters specified in the drawings. In the case of non-interchangeable work, the system of marking shall be in accordance with the drawings prepared by the tenderer and approved by the Purchaser.

3.10 Packing

All projecting plates or bars shall be kept in shape by timber or angle bars spiked or bolted to them, and the ends of the chord lengths, end posts and plate girders at their shipping joints shall be protected and stiffened so as to prevent damage or distortion in transit as the Inspecting Officer may direct.

All threaded ends and machined surfaces are to be efficiently protected against damage in transit. The parts shall be sent out in lengths convenient for transport. All straight bars and plates except small pieces are to be sent out in convenient bundles temporarily rivetted or bolted together or bound with wrought iron or suitable wire as the Inspecting Officer may direct. All rivets, bolts, nuts, washers, plates under 300 mm square and small articles generally are to be packed separately for each span in cases each weighing, when full, not more than 350 kg, or in strong petroleum casks, or in barrels approved by the Inspecting Officer. If not entirely filled by the contents the space left shall be closely packed with wood shaving or other suitable material. Bolts and rivets of different sizes shall be separately packed in bags, each bag having a label indicating its contents. A list of the contents shall be placed in the top of each case or cask. In the case of imported material all cases shall be made of 32mm boards with ends nailed with 90mm wire nails strengthened by battens and 38mmx 1.6mm (No. 16 BG) hoop -iron and made thoroughly secure for transit to India. All casks shall be in sound condition, and if not entirely filled by the contents the space left shall be closely packed with wood-wool or other suitable material. The heads shall be firmly secured by means of hoops in the usual way, and in addition each head shall be further secured by a strong wooden batten and not less than two strips of 1.6mm (No.16 BG) hoop- iron passing over the head and nailed to the staves on both sides. The hop-iron shall be long enough to pass over two hoops on each side of the cask and be nailed in such a manner that the hoops cannot slack back. Bolts and rivets of different sizes shall be packed in a separate canvas bags, each bag having a label in dictating its contents. End field holes to be bolted in case of members having split in plate and channels.

3.11 Dispatch or Shipping marks

Each package, case or bundle is to have clearly stenciled on it in good oil paint the address as stated in the order of contract, gross and net weight description of contents and such marks as may be required by the Purchaser must be shown against each item in the invoice. The Contractor is to provide necessary stencil plates for marking. Every piece of bundle shall be marked and in the case of material (shipped to India) all cases or casks shall be clearly cut or branded, not merely painted, with their net and gross weights and with such shipping marks and other particulars as the Inspecting Officer may direct and each bundle shall also have a metal label securely attached with wire stamped with similar marks. The marking shall be done with thick oil paint and in such a manner that it cannot be washed off or obliterated.

3.12 Loading

All trucks or wagons are to be loaded to as near their full capacity as is consistent with safe transport. While loading the material in wagon, truck or trailer, care should be taken that heavier material is loaded first and lighter material is kept on top so that lighter material is not damaged due to heavy weight. While transporting the material by road, adequate safety precautions shall be taken as per extant instructions.

The Contractor shall apply all dunnage and lashing required to hold the material securely in position free of charge.
While handling any girder or girder component it shall be ensured no damage to material takes place in the form of dent/cut mark etc. Wooden blocks, rubber pads shall be used to avoid direct contact between materials to be handled and handling equipment.

3.13 Tracings and Printings

Except in the case of standard spans fabricated without any modifications to the standard drawings the Contractor shall supply free of charge, one set of neatly executed tracing on linen. They shall be fully dimensioned and contain all erection marks, notifications as to the colour the work has been printed, the name of the Contractor and any alterations from the contract drawings, which may have been made in executing the work. The drawings shall conform to standard sizes as given in IS: 962 and shall not exceed AO size. The drawings shall not be folded but rolled outwards on a roller, in addition to three sets of full size copies on strong paper made by an approved process.

3.14 Rivets and Bolts lists

The Contractor shall also supply, without charge, three complete lists of the rivets, bolts, service bolts, washers and drifts required for erecting the work at site, showing the parts of the work to which the various rivets and bolts belong and having each item marked so as to indicate the particular case in which it will be found.

4.0 Assembly, Erection and Launching

4.1 General

Technical specifications given herewith are just for guidance of the erection/launching contractor. In case of difference as compared to the codal provisions, provisions of the codes shall prevail. Regarding this, decisions of the Engineer shall be final.

The Contractor shall provide at his own cost all tools, machinery, equipment and erection material, including all temporary works and shall assemble all components in every respect as stipulated in the contract and in accordance with approved drawings and specifications.

It is the responsibility of the erection/launching contractor to submit the erection/launching plan for dry span as well as water span both. The same shall be checked by the consultant and finally approved by the client / Engineer. Work shall be done as per the approved plan and the approved methods statements submitted by the erection/launching contractor.

Erection/launching contractor while finalizing the methods statements shall go through the details contained in this tender document as well as the referred codes and manuals and finalize the procedures along with specifications. The procedures/specifications/methods statements submitted by the erection/ launching contractor shall be at least at par with the details given herewith or superior to that.

On account of drawings under still finalization, it is possible that certain details contained in this tender document either might be missing or might be superfluous. In case of missing details, the erection/ launching contractor shall supplement the same, which shall be ultimately approved by the Engineer in consultation with the Consultant.

The supply, fabrication, erection & launching contractor shall note that payment shall be made strictly as per the Bill of Quantities. Nothing beyond that shall be payable. Contractors are advised to quote their rates accordingly.

Erection/launching contractor shall be totally responsible for the safe working. Following of the procedures contained herein does not mean that in case of any type of mishap, erection/launching contractor shall not be responsible. Erection/launching contractor shall examine each and every aspects and suggest some changes in procedures wherever he thinks like that, for the approval of Consultant and Engineer.

Trial launching of two spans (As per instruction of Engineer) will have to be done at ground level. While doing the trial launching all temporary/ permanent connection/ strengthening will have to be provided and all operations as per actual launching will have to be done. All fabrication material to be used in bridge girders shall be provided by contractor. Problem faced during the trial launching will have to be addressed before final launching is taken up. Trial launching shall be considered as part of the launching work, and for that, no extra payment shall be made. If the trial assembly is done within river bed (dry span) these girders may be raised to the bearing level and place on piers in position if so desired by the tenderers.

While doing the erection /launching work, the erection/ launching contractor shall follow the standard practices to ensure design Camber after erection /launching of the bridge girders.

4.2 Drilling and Sub-punching

All holes shall be drilled but the Contractor may, if he/she so prefers sub-punch them to a diameter 6mm less than that of finished holes, e.g. a punched hole which is to be drilled out to 25mm in diameter shall not exceed 19mm in diameter at the die end. When the rivet holes are to be sub-punched, they shall be marked with a centre punch and made with a nipple punch or preferably, shall be punched in a machine in which the position of the hole is automatically regulated. The punching shall be so accurate that when the work has been put together before drilling, a gauge 1.5mm less in diameter than the size of the punched holes can be passed easily through all the holes. Holes for countersunk heads of rivets, bolts or screws shall be drilled to the correct profile so as to keep the heads flush with the surface Holes for countersunk heads of rivets, bolts or screws shall be drilled to the correct profile so as to keep the heads flush with the surface. No sub-punching shall be allowed in the main truss members of open-web girders. Holes for turned bolts should be 1mm under drilled in shop and should be reamed at site to suit the diameter of turned bolt.

Where the number of thicknesses to be riveted exceeds three or the total thickness is 90mm or more, the rivet holes, unless they have been drilled through steel-bushed jigs, shall be drilled out in place 3mm all round, after assembling. In such cases the work shall be thoroughly bolted together.

The steel bushes shall be case hardened by an approved process and checked for diameter after the heat-treatment. The bores of bushes shall initially have a tolerance of -0mm, 0.1mm. The tolerance shall be checked from time to time and when the bores exceed a tolerance of, -0mm, +0.4mm, the bushes shall be rejected. For this purpose, go and no-go gauges are to be used. Tolerances for checking jigs from master plates shall be +0 mm -0.13 mm.

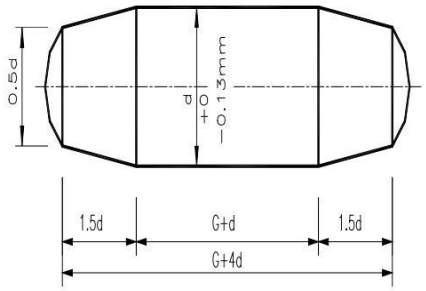
The work shall be taken apart after drilling and all burrs left by the drill and the sharp edges of all the rivet holes completely removed.

4.3 Parts in Contact

All steel work intended to be riveted or bolted together shall be in contact over the whole surface.

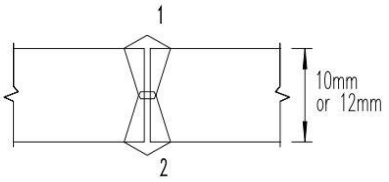
Drifts as shown in Fig. No.-1 may be used for drawing light members into position but their use on heavy members should be restricted to securing them in their correct positions. In no case, shall drifting be allowed to such an extent that holes are distorted.

PARALLEL BARREL DRIFT

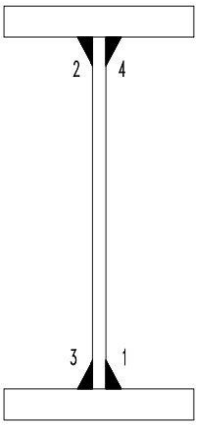


d. IS THE NOMINAL DIAMETER OF THE HOLE.
G. IS THE COMBINED THICKNESS OF THE METAL THROUGH WHICH THE DRIFT HAS TO PASS.
STEEL- IS: 1875 OR IS: 7283

FIG.-2
(REF. CLAUSE 19 & 20)



Sketch showing sequence of square butt welding



Sketch showing the sequence of fillet welding for fabricating the I-section

FIG.-3
(REF. CLAUSE 27)

Figure No.-1

Drifting to enlarge un-faired holes is prohibited. The holes that will have to be enlarged to admit rivets should be reamed provided the Engineer permits such reaming after satisfying himself about the extent of inaccuracy and the effect of reaming on the soundness of the structure. The Purchaser retains the right to reject all steel work if the holes are not properly matched.

4.4 Making of Joints

Cleaning of permanent contact surfaces: Surfaces which will have permanent contact shall be removed of paints and mill scale down to bare metal, clean and dried and immediately a coating of red lead to IS: 102 shall be applied. Care shall be taken to see that all burrs are removed and no surface defects exist before the parts are assembled.

4.4.1 Bolting and drifting

Only barrel drifts as per Fig. No.-1 shall be used in erection. They may be used for drawing light members into position; but their use on heavy members shall be restricted to securing them in their correct position. Any apparent error in shop work, which prevents the assembling and fitting up of the parts by the proper use of these drifts, shall be investigated immediately. As all work is rigidly inspected in the manufacturers work before dispatch, these difficulties should not arise and the cause should be first be sought in the use of incorrect components or the transposition of a correct part. It is usually important that parts should be correctly handled. Should error still persist, the matter shall be immediately reported to the Engineer who will decide what action is to be taken. No reaming shall be undertaken without the written authority of the Engineer, except for the under drilled holes meant for turned bolts. If approved, the Contractor shall supply, at his/her own expense, any special rivets that maybe required. Copies of all correspondence relative to the recourse to reaming and the use of over-size rivets shall invariably be sent by the Engineer for information to the inspectorate concerned.

Joints shall normally be made by filling not less than 50% of the holes with service bolts and barrel drifts in the ratio of four to one. The service bolts are to be fully tightened up as soon as the joint is assembled.

4.4.2 Special methods of erection other than described in Appendix III of IRS B1-2001 Specification

In cases where the joints have to withstand stresses arising from special method of erection, provision is to be made to take the whole stress that will or may occur. Cylindrical drifts and turned bolts shall be used to withstand such stresses and no reliance is to be placed on the service bolts for this purpose. Up to maximum of 40% of the holes of each member of the joint are to be filled with drifts and balance of strength required is to be attained with turn bolts. The Engineer will intimate the position and number of the drifts and bolts. The condition of “Making of Joints” of this technical Specification must be observed and the bolt fully tightened up as soon as the joint is made.

Where the manufacturing of girders has been done in accordance with “Interchangeability” of this specification relating to steel girder bridges, the erection shall be done in accordance with Appendix III of IRS B1-2001 Specification or the methods suggested by the erection/launching contractor dully approved by the Consultant and the Client.

4.4.3 **Emergency jointing**

In the event of an emergency arising such as the staging is in danger of being carried away by floods before the riveting can be completed, the joints shall be made secure by filling 40% of the holes with cylindrical drifts and equal number with service bolts fully tightened.

4.5 Erection and Equipment

The erection/launching contractor shall provide at his/her own cost all tools, machinery, equipment and erection material necessary for the expeditious execution of the work and shall erect the structural steel and iron work, in every respect as covered by the contract and in accordance with the drawings and specifications.

Before starting the work, the Contractor shall advise the Engineer fully as to the method he/she proposes to follow and the amount and character of equipment he/she proposes to use, which shall be subjected to the approval of the Engineer. The approval of the Engineer shall not be considered as relieving the Contractor of the responsibility for the safety of his/her method or equipment or from carrying the work in full accordance with the drawings and specifications.

All temporary work shall be properly designed and substantially constructed for the loads, which it will be called upon to support. Adequate allowance and provision of a lateral forces and wind loads shall be made according to local conditions and ensure that support shall not settle during erection. Careful and periodical inspection of plants shall be made by the Contractor to ensure that all tackle, ropes, chains and other important lifting gear and machinery are in good order and fit for service and well up to the capacity for which they are required. When chains are used for lashing, care must be taken to protect the edges of members to avoid the marking and distortion otherwise caused. Span erected upon staging shall be supported upon suitable blocks, which shall ensure that the girders shall be at the correct elevation and alignment when completed. If other methods of erection be adopted where staging in situ is not employed, special means shall be used to ensure this. The method used for lifting and slinging flexible members shall be brought to the notice of the Engineer and shall be subject to his/her approval. Temporary bracing shall be provided to take care of stresses from erection equipment or other loads carried during erection.

4.6 Bearings & Anchorages

Bed plates shall be set to required level and fixed accurately in position by giving full and even bearing by setting them on a layer of cement sand and cast iron chips as approved and directed by the Engineer. The Contractor shall drill the holes where necessary and set the anchor bolts. The bolts shall be set accurately and fixed with cement grout or any other grouting material as approved by the Engineer completely filling the holes.

4.7 Arrangement of Drifts, Nuts, Bolts etc. and all other Consumables required in this work

All required drifts, nuts, bolts and other fasteners including all types of consumables as required shall be procured by the erection/launching contractor at his/their own cost for use of the same in the erection/launching work. All such materials shall conform to IRS/IS specifications.

4.8 Field Rivets

All field rivets required in connection with the erection work shall be arranged by the erection/launching contractor at his/their own cost. Since the fabricated components are high tensile steel and mild steel both, rivets to be used shall be of high tensile steel only.

4.9 Rivets and Rivetting

The dimensions on the drawings referred to the diameters of the rivet holes and their finished rivets. The rivet holes shall be 1.5 mm greater than the diameter of the rivet bars used. The rivets shall be made as per the IS specifications. The shanks of the un- driven rivets shall be made of a length sufficient to fill the holes thoroughly and form the head. The clearance i.e. the difference in diameter between the rivets measured under head before being heated and the rivet hole shall not be less than 0.75mm. Before riveting is commenced, all works shall be properly bolted so that the sections riveted are in close contact throughout. Rivets shall completely fill the holes and shall be machine driven by means of pressure or percussion riveters of approved design.
All rivets shall be properly heated to straw heat for the full length of the shank, firmly backed and closed. The head of the rivet, particularly in long rivets, shall be heated more than the point and in no case shall the point be heated, more than the head. Sparking or burnt rivets shall not be used. Where it is impossible to back up by normal method of holding up, 'double gunning' may be resorted to. Alternatively, pneumatic holding device may be used.

Gauges for rivet dimensions and contours shall be provided by the Contractor for the use of the Inspecting Officer.

Rivets when driven shall completely fill the holes, have the heads concentric with the shanks and shall be in full contact with the surface. Driven rivets when struck sharply on the head with the 110-gm. rivet testing hammer, shall be free from movement or vibration.

While riveting built-up members, full care should be exercised to ensure that the set of holes for field rivets in each flange of the built-up member, is aligned dead-square in relation to that in the other flange and not 'aborted'. Use of assembly fixtures shallbe made to ensure this.

All loose and burnt rivets and rivets with cracks, badly formed, eccentric or deficient heads shall be cut out and replaced. Permissible deviation of driven rivets shall be as per Appendix IV of IRS B1-2001 Specification. For ready reference, the same has been produced in the "Quality Control" part of this technical specification. Rivets shall also be cut out when required for the examination of the work. Actual method of cutting out shall be approved by the Engineer. Re-cupping and caulking shall in nocircumstances be resorted to.

Riveting shall not be started until such time as the Engineer has personally satisfied himself that the alignment of the girders is correct, the verticals plumb laterally, the camber according to that shown on the camber diagram with camber jacks screwed tight, all the joints and cover plates well up, service bolts tight and field rivet holes coinciding. Special care should be taken that service bolts are frequently re-tightened as the riveting proceeds.

All field rivets shall be tested as directed by the Engineer.

Where practicable all riveting shall be done by pneumatic or hydraulic riveting machine. The working pressure to be employed when using pneumatic or hydraulic tools shall be approved by the Engineer. Hand riveting shall only be done when specified in the drawing and approved by the Engineer. In such cases, means shall be adopted to ensure the rivets being used in their entire -only to give the correct form of head. When all the rivets of joints have been finally passed, they shall be painted as under. One coat of ready mixed zinc chrome primer to IS: 104 followed by one coat of ready mixed paint red oxide zinc chrome primer to IS: 2074.

Finishing coat as per painting schedule given under "Oiling, Painting and Metallizing" of this technical specification. For further details on the riveting, "Indian Railways Bridge Manual" can be referred to.

4.10 Field Rivets, Bolts, Nuts and Service accessories

The work is to include supply of all units, bolts, nuts, washers etc. required to complete erection at site with an allowance for wastage etc. of 12.5% of the net number of field rivets, bolts and washers required subject to a minimum number of five in each item.

The Contractor shall be responsible for supplying site rivets of approved length. The length of such rivets shall be verified by snapping a few rivets of each length in the presence of the Inspecting Officer. In the case of rivets with long grips (with grip exceeding 6 times the diameter) specimen rivets on the test piece shall be cut to see if the holes are totally filled even though the rivets are tight under the usual hammer tests.

Black hexagonal bolts (Service bolts) with nuts and ordinary platter's washers and drifts for use in the erection of the work shall also be supplied at 60% (45% bolts and 15% drifts) of the number of field rivets per span in each size (this includes wastage). The Purchaser may however, specify a reduction in the quantities of service bolts etc.if more than one span of each type is ordered.

4.11 Smithed work

All joggles shall be performed by pressure. Craned sections or knees can be formed by forging or by gas cutting and welding by any approved electric arc process. Any bending, forging, cutting or welding shall be carried out in such a manner as not to impair the strength in the metal. Forging shall be annealed as indicated in the drawing.

If drop forging through dies is resorted to, excessive forging in one operation shall be avoided. Where necessary, a series of intermediate stage dies shall be manufactured and used.

4.12 Welding

Normally, field welding are not allowed for bridge works. Only in special circumstances, with the approval of Engineer, field welding's are being carried out and that too, as per the approved plan. Welding details given herewith shall only be used in special circumstances.
Welding of the bridge girders shall be done under strict supervision of the Engineer and Approved procedures shall be followed.

4.13 Transports from Workshop & Stacking at Site

All items fabricated in the workshop shall be marked and packaged with accompanying package list. Contractor shall be liable for all losses and damages in transit for the materials consigned by him till materials are erected and work completed and taken over by the Engineer. Insurance against loss or damage in transit,if any, shall be the responsibility of the contractor.

After identification & correct marking, all components of each girder shall be dismantled & similar components shall be grouped together & labeled; rivets bolts andplates of each size shall be packed separately in the manner described elsewhere in this tender document, after approval by the inspecting authority.

The packages shall be of such size by length & weight that they are safely transportable by Road. The components shall be provided with necessary packing to avoid damage to painting & members in transit.

Dimensions for transport shall be as per standard schedules.

4.14 Assembly at Site

Holes:

After drilling holes in temporary tack assembled components, the components shall betaken apart after match marking and all burrs left by drill and sharp edges of all holes shall be removed by spot grinding to ensure full contact when assembled.

Assembly fixture shall be used to build components for turned bolt connection. These connections will help realize correct position of member and matching of coaxial holes in opposite members besides true alignment and level.

After assembly, all blank holes shall be checked with plug gauge of diameter 0.8mmless than hole diameter, to check fair matching of holes before riveting.

Drifts:

Drifts as per IRS specifications may be used for drawing light members into position,but their use on heavy members should be restricted. In no case shall the drifting be allowed to such an extent that holes are distorted. Drifting to enlarge the unpaired holes is prohibited.

Reaming:

The holes that will have to be enlarged to admit rivets should be reamed subject to approval of Engineer/Inspecting Officer who will satisfy himself about the extent of inaccuracy and the effect of reaming on the soundness of the structure. The Contractor shall supply special rivets to fill reamed holes, where reaming is approved. Record of all such variations shall be maintained. However, these provisions should not apply for under drilled holes meant for turned bolts. Copies of all correspondence pertaining to the recourse of reaming and the use of over size rivets shall be sent by the contractor for information to Engineer.

Making of joints:

Care shall be taken to see that all burrs are removed and no surface defects exist before the parts are assembled. The mating surfaces shall establish full contact when assembled. In cases where the joints have to withstand stresses arising from special methods of erection, provision is to be made to take the whole stress that will or may occur. Cylindrical drifts and turned bolts shall be used to withstand such stresses and no reliance is to be placed on service bolts for this purpose. Up to a maximum of 40 percent of the holes of each member of the joint are to be filled with drifts and balance of strength required is to be attained with turned bolts. The position and number of the drifts and bolts will be decided / approved by Engineer.

Painting of Joints:

All surfaces, which are in permanent contact, shall be thoroughly cleaned down to the bare metal, to remove mill scale and grease etc. They shall be painted immediately before assembly with one coat of red lead conforming to IS:102 and raw linseed oil freshly ground and the surface prepared for painting as per painting specification.

4.15 Assembly and Launching

i. The assembling of components at site to required camber and grade along bridge axis, preceding additional temporary structures and accessories for launching of girders and all related matters shall be full responsibility of the contractor.

ii. The launching of girders shall be done as per approved drawings. For this purpose, the contractor shall submit in triplicate, detailed launching schemes of all the girders including design calculations, safety procedures and method statement with such plans, sketches and other details as may be necessary to determine the suitability and adequacy of the schemes proposed. The methods adopted shall not, under any circumstances, cause the stresses in various members of girder spans to exceed permissible and safe limits at any stage of launching. One copy duly approved by the Engineer shall be returned to the contractor.

iii. For the Engineer's use and record, the contractor shall supply free of charge, four sets of prints on strong paper and one set of neatly executed tracings on linen of approved detailed drawings for assembly and launching schemes for use at site.

iv. The contractor shall provide full structural details of the temporary members and their connections to the girder, along with necessary design calculations not only justifying members sizes but also of the entire launching system adopted. Contractor will be responsible for getting approval of launching scheme submitted by him from the Engineer.

v. In order to ensure perfect fit of the temporary components, holes may be carefully drilled for the connecting members in between the girders in situ and T & F High tension grip bolts used.

v. The launching system shall be test tried if directed by the Engineer and no separate payment for this shall be made.

vi. Nothing extra will be paid to the contractor for adopting any scheme for launching and the costs are to be covered in the relevant item in the schedule of items, quantities and rates. All temporary members shall be removed after launching and may be taken back by the contractor. Erection gussets provided for connecting the members may be cut and edges ground as directed /approved by the Engineer.

4.16 Permanent/Temporary Strengthening

The launching arrangement may include launching nose or restraining girders, sway restraining devices such as sway ropes, restraining cables etc. The supply and fixing of members for temporary strengthening of girder members to take care of erection stresses and strains and other relevant components for satisfactory and successful completion of the defined scope of work. Erection stresses must be kept within safe and permissible limits at every stage of erection.

The contractor has to make arrangements at his own cost for the steel for temporary arrangements including sway restraining devices for launching, as may be required for the launching operations. The rate quoted should take into account these factors as nothing extra shall be paid.

Launching scheme may also require temporary/permanent strengthening of some members, which will be done by contractor. Any work required to be done at site for launching with materials to be arranged and supplied by contractor.

4.17 Inspection and Rectification

During erection of girders, the contractor shall provide all facilities and permit the Engineer to inspect the field assembly, site riveting and erection of spans to the satisfaction of engineer.

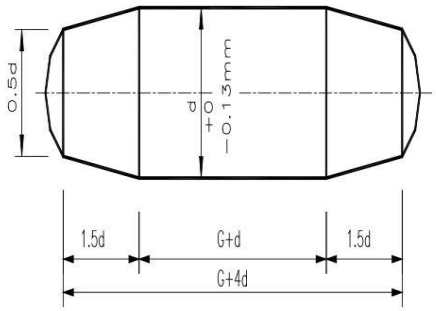
After inspection by the Engineer/ Inspecting agency, the contractor shall identify cause of any defect, imperfection and/or fault noticed during such inspection and initiate corrective action as per the direction of the Engineer. All defects, imperfections or faults, shall be made good by the contractor to the Engineer's satisfaction and the cost of identifying and rectifying such defects, imperfection or faults shall be borne by the contractor.

4.18 Additional Requirements for Superstructure

SKETCHES

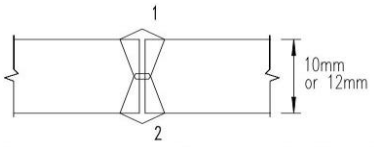
In this portion, some sketches useful to the fabrication work have been given for the benefitof the tenderer. In case further elaboration is required, tenderer will develop his own sketch and get approval of the Engineer.

PARALLEL BARREL DRIFT

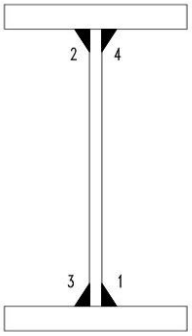


d. IS THE NOMINAL DIAMETER OF THE HOLE.
G. IS THE COMBINED THICKNESS OF THE METAL THROUGH WHICH THE DRIFT HAS TO PASS.
STEEL– IS: 1875 OR IS: 7283

FIG.–2
(REF. CLAUSE 19 & 20)



Sketch showing sequence of square butt welding



Sketch showing the sequence of fillet welding for fabricating the I–section

FIG.–3
(REF. CLAUSE 27)

Fig. No. 1

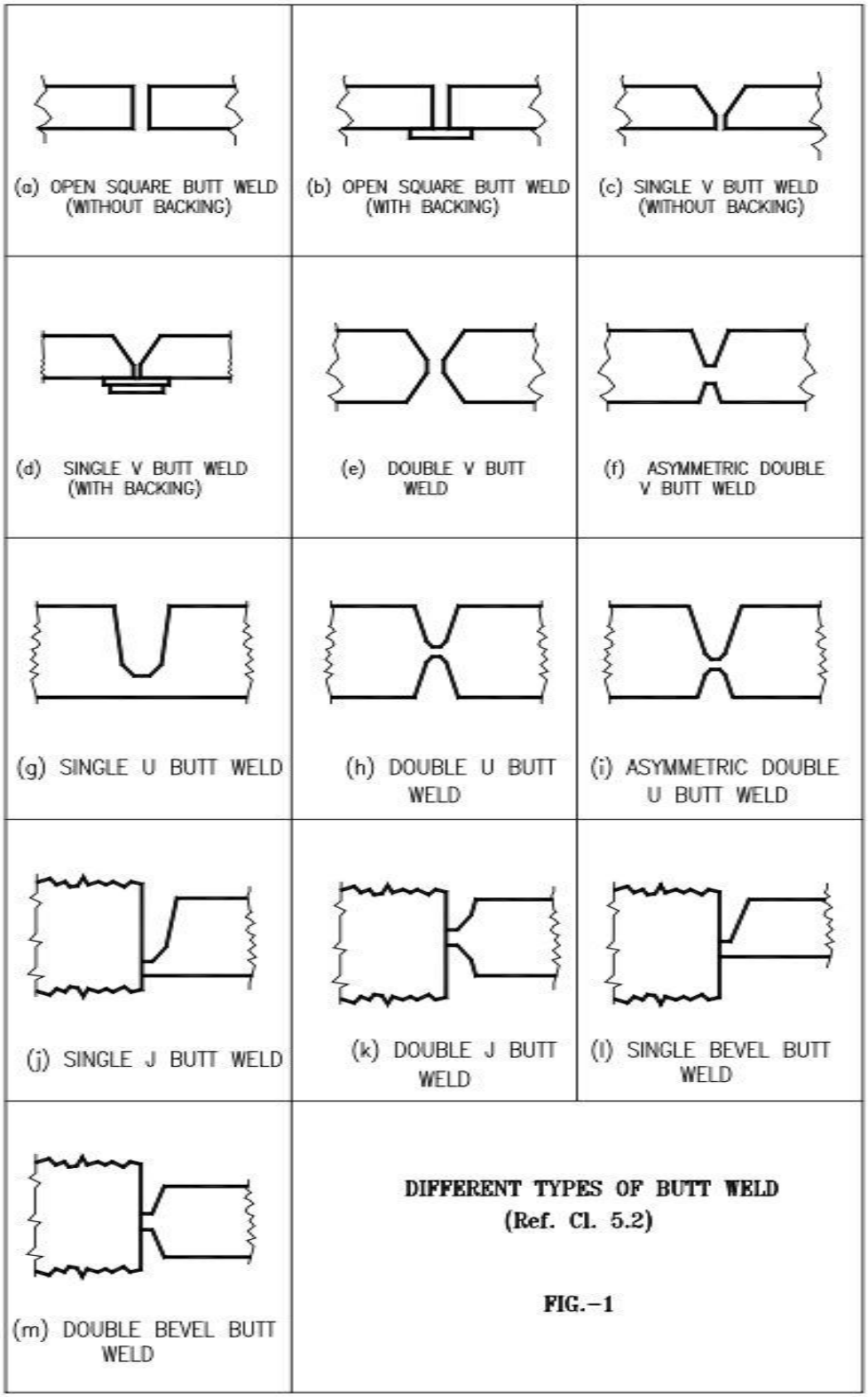
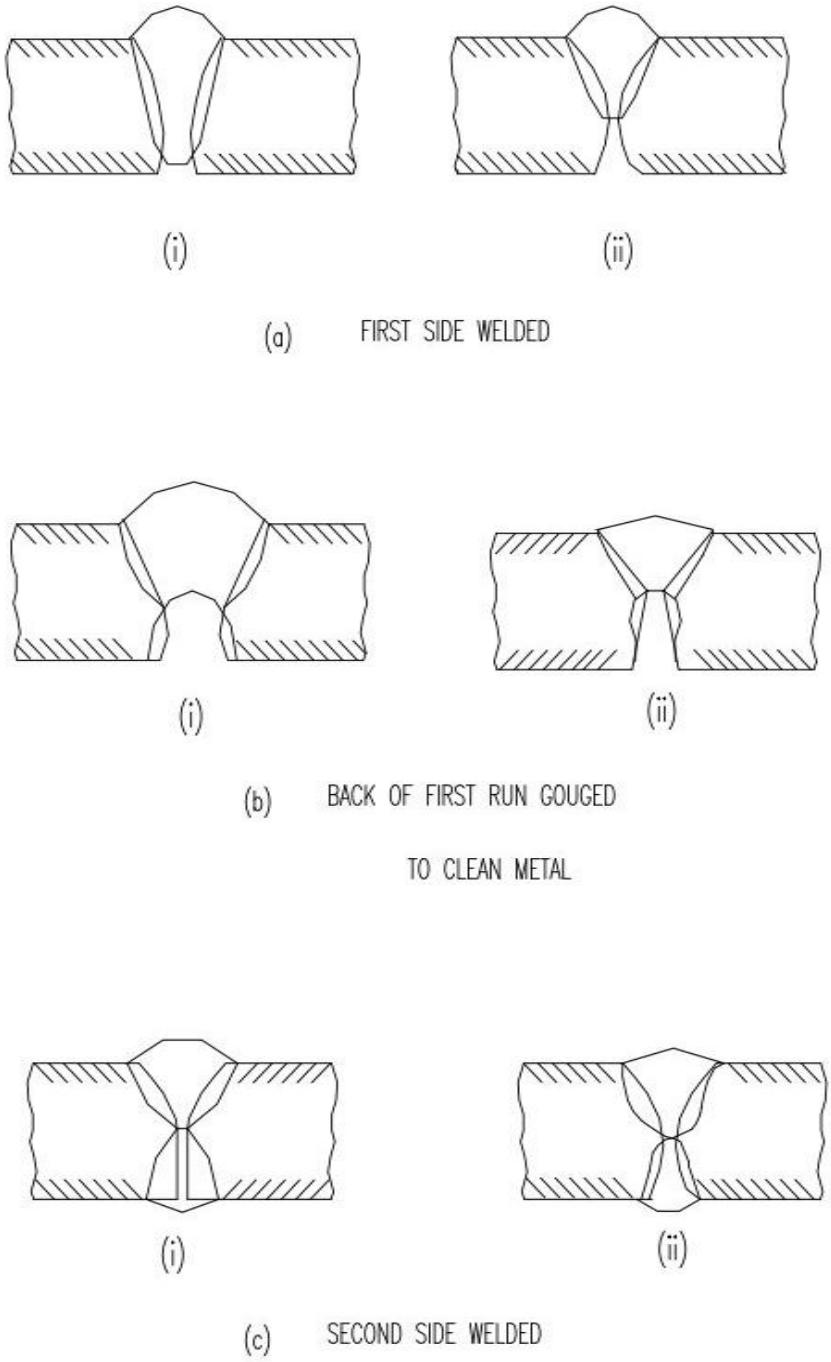

(a) OPEN SQUARE BUTT WELD (WITHOUT BACKING)
(b) OPEN SQUARE BUTT WELD (WITH BACKING)
(c) SINGLE V BUTT WELD (WITHOUT BACKING)
(d) SINGLE V BUTT WELD (WITH BACKING)
(e) DOUBLE V BUTT WELD
(f) ASYMMETRIC DOUBLE V BUTT WELD
(g) SINGLE U BUTT WELD
(h) DOUBLE U BUTT WELD
(i) ASYMMETRIC DOUBLE U BUTT WELD
(j) SINGLE J BUTT WELD
(k) DOUBLE J BUTT WELD
(l) SINGLE BEVEL BUTT WELD
(m) DOUBLE BEVEL BUTT WELD
DIFFERENT TYPES OF BUTT WELD
(Ref. Cl. 5.2)
FIG.–1

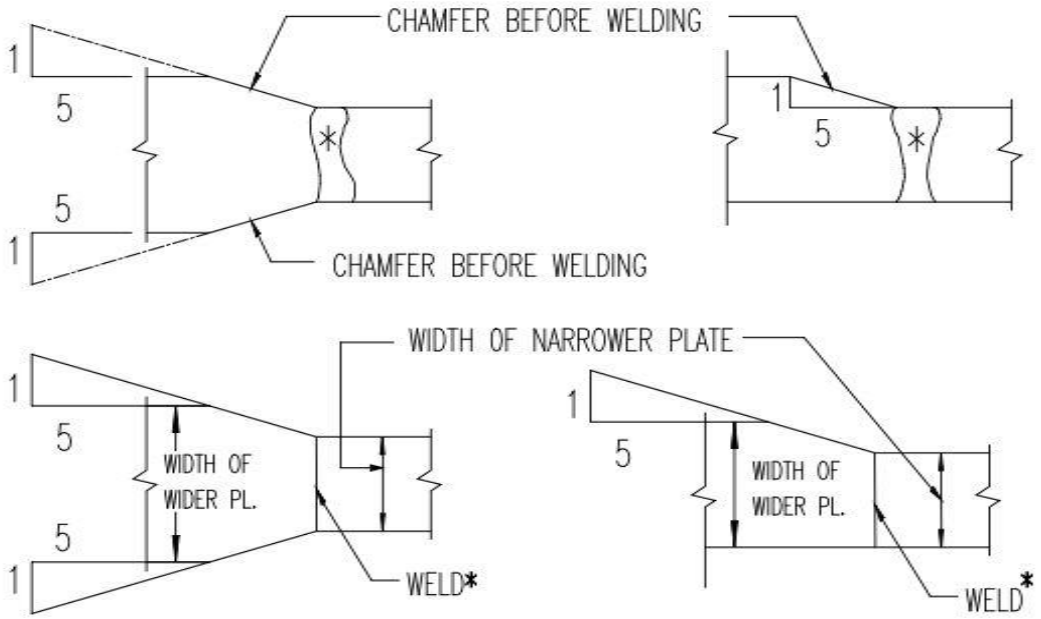
Fig. No. 2 : Different types of Butt Welds



Diagrammatic Representation
Method of Gouging out complete
Penetration butt joints welded from both sides

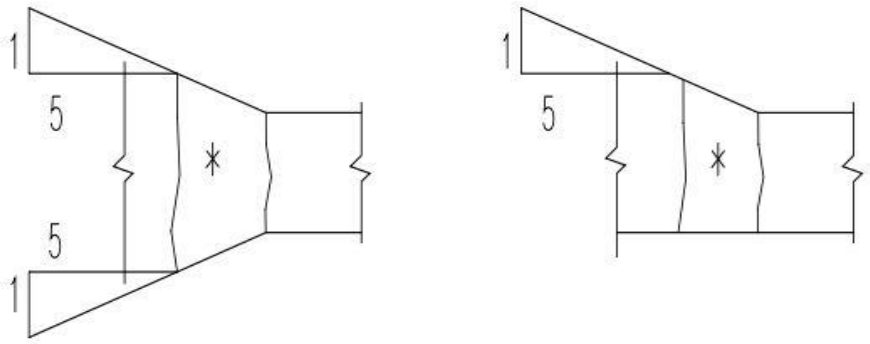
Fig. No. 2

Fig No.-3: Diagrammatic representation of method of gauging out complete penetrationbutt joints welded from both ends.



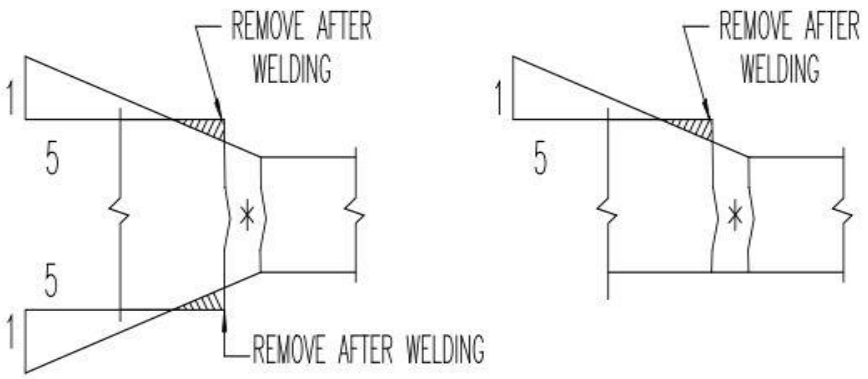
TRANSITION BY CHAMFERING THICKER OR WIDER PART

FIG.-3



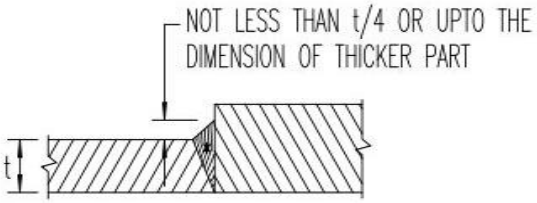
TRANSITION BY SLOPING WELD SURFACE

FIG.-4



TRANSITION BY SLOPING WELD SURFACE AND CHAMFERING

FIG.-5



BUTT WELD WHERE TRANSITIONING IS NOT PRACTICABLE

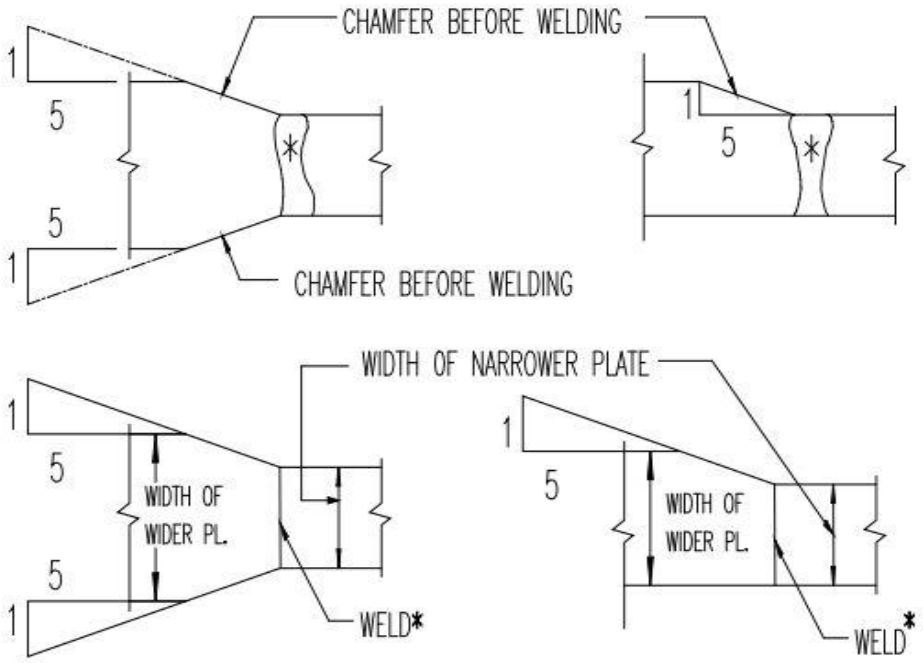
FIG.-6

NOTE:-

1. * WELD MAY BE OF ANY PERMITTED OR QUALIFIED TYPE & DETAIL.
2. TRANSITION SLOPES SHOWN ARE THE MAXIMUM PERMITTED.

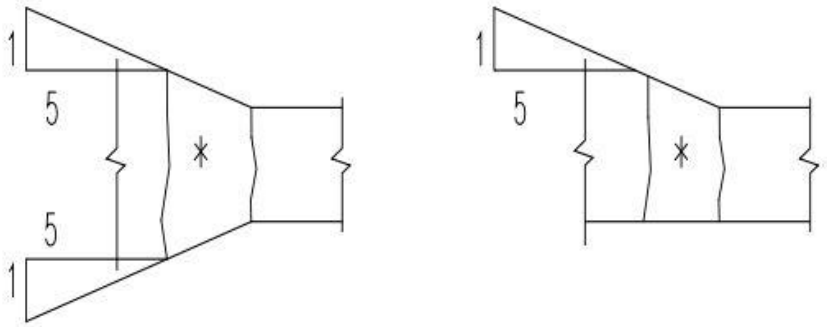
BUTT WELDING PARTS OF UNEQUAL CROSS SECTION

Fig. No. 4



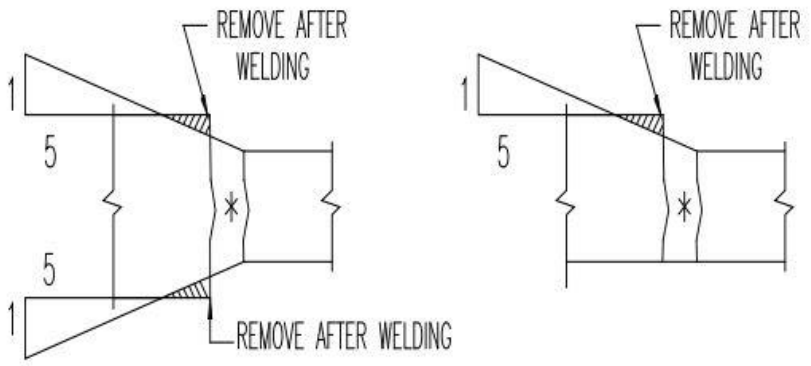
TRANSITION BY CHAMFERING THICKER OR WIDER PART

FIG.-3



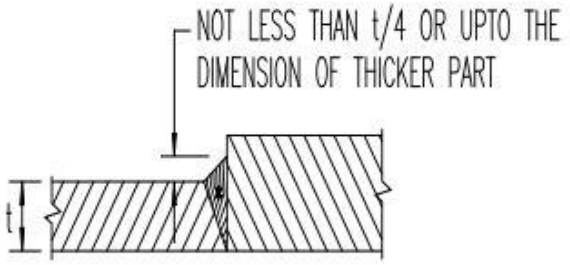
TRANSITION BY SLOPING WELD SURFACE

FIG.-4



TRANSITION BY SLOPING WELD SURFACE AND CHAMFERING

FIG.-5



BUTT WELD WHERE TRANSITIONING IS NOT PRACTICABLE

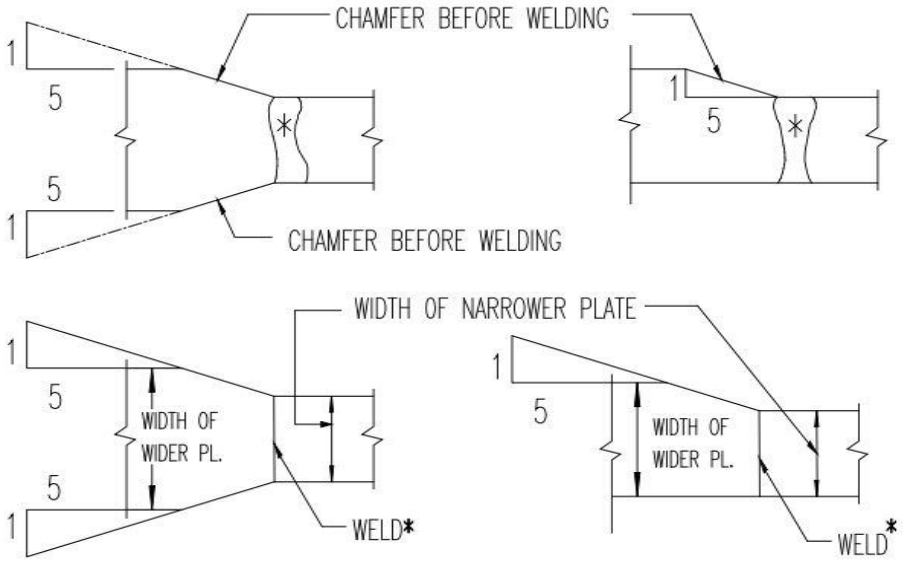
FIG.-6

NOTE:-

1. * WELD MAY BE OF ANY PERMITTED OR QUALIFIED TYPE & DETAIL.
2. TRANSITION SLOPES SHOWN ARE THE MAXIMUM PERMITTED.

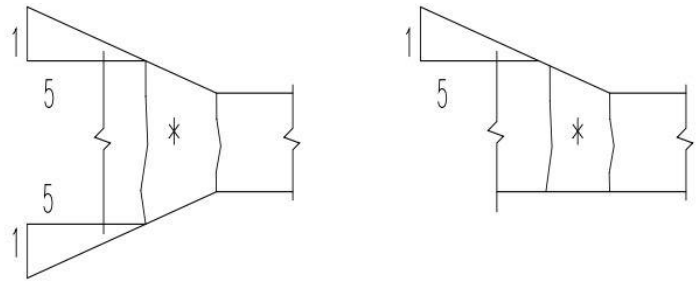
BUTT WELDING PARTS OF UNEQUAL CROSS SECTION

Fig. No. 5



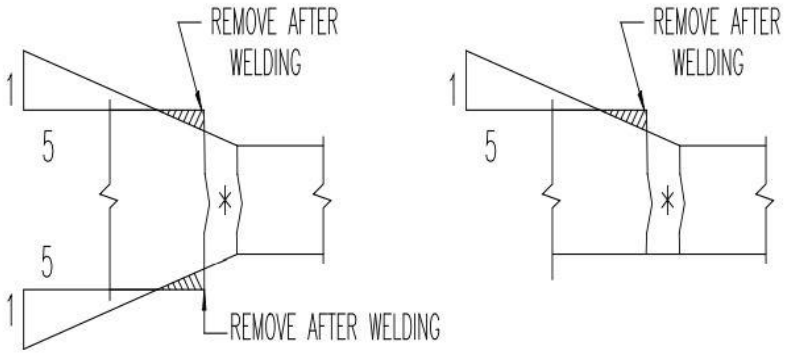
TRANSITION BY CHAMFERING THICKER OR WIDER PART

FIG.–3



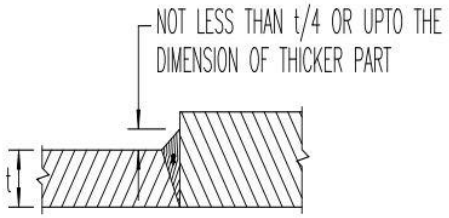
TRANSITION BY SLOPING WELD SURFACE

FIG.–4



TRANSITION BY SLOPING WELD SURFACE AND CHAMFERING

FIG.–5



BUTT WELD WHERE TRANSITIONING IS NOT PRACTICABLE

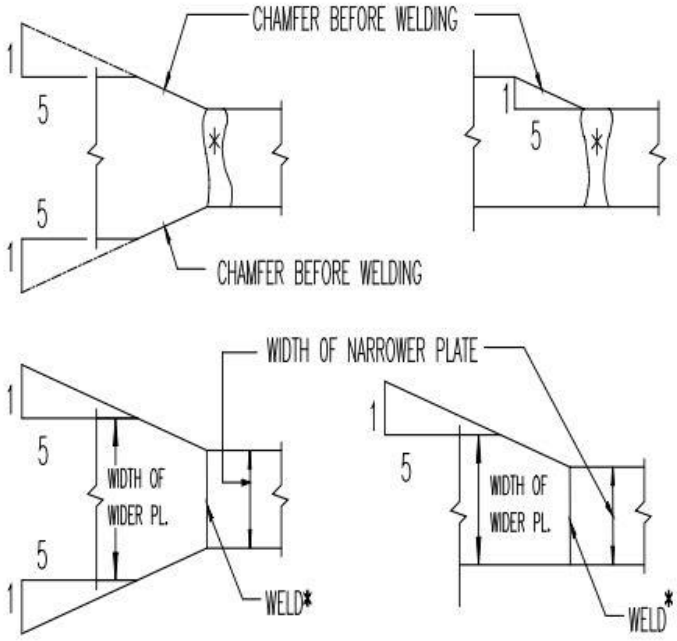
FIG.-6

NOTE:-

1. * WELD MAY BE OF ANY PERMITTED OR QUALIFIED TYPE & DETAIL.
2. TRANSITION SLOPES SHOWN ARE THE MAXIMUM PERMITTED.

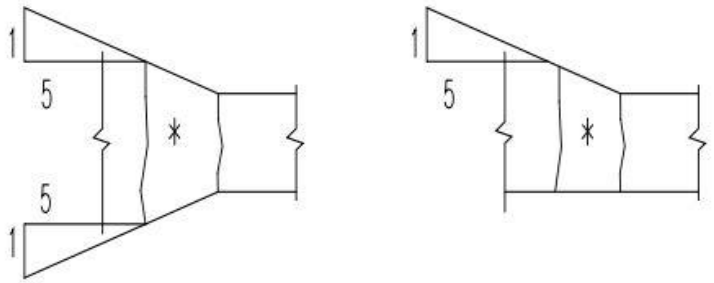
BUTT WELDING PARTS OF UNEQUAL CROSS SECTION

Fig. No. 6



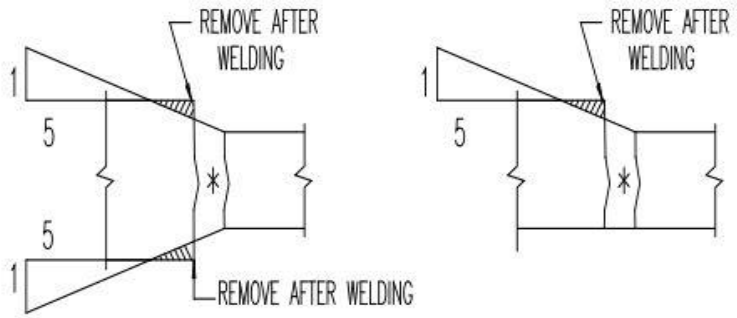
TRANSITION BY CHAMFERING THICKER OR WIDER PART

FIG.-3



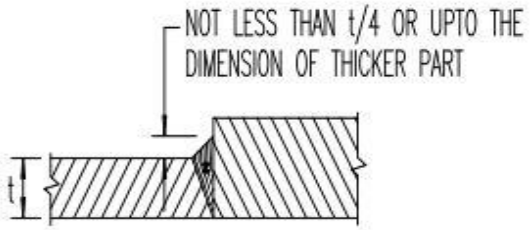
TRANSITION BY SLOPING WELD SURFACE

FIG.-4



TRANSITION BY SLOPING WELD SURFACE AND CHAMFERING

FIG.-5



BUTT WELD WHERE TRANSITIONING IS NOT PRACTICABLE

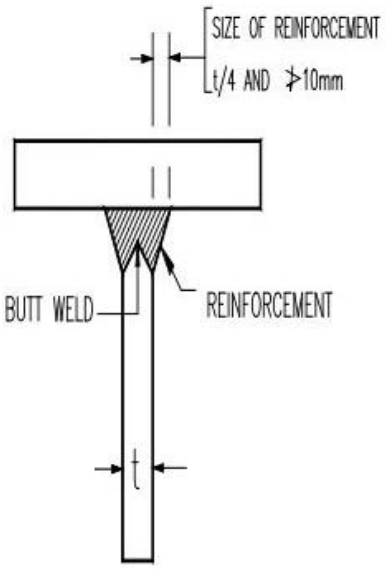
FIG.-6

NOTE:-

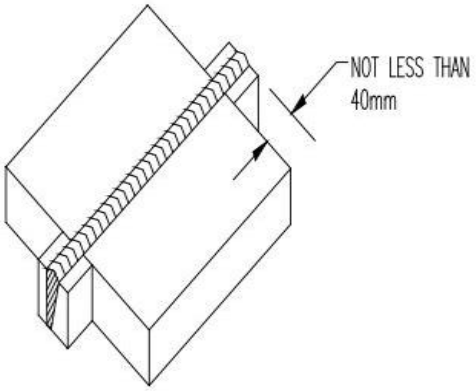
1. * WELD MAY BE OF ANY PERMITTED OR QUALIFIED TYPE & DETAIL.
2. TRANSITION SLOPES SHOWN ARE THE MAXIMUM PERMITTED.

BUTT WELDING PARTS OF UNEQUAL CROSS SECTION

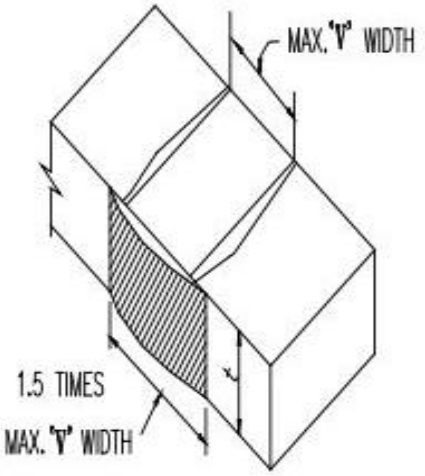
Fig. No. 7



Butt Welded T Joint
Fig. 7

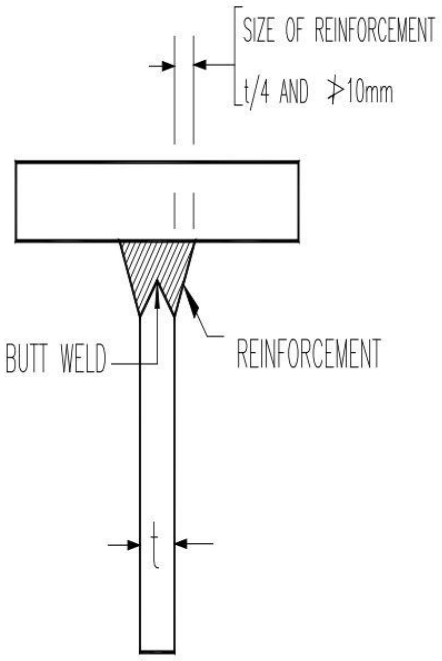


Butt Welded Joint with Run-On and Run-Off Plates
Fig. 8

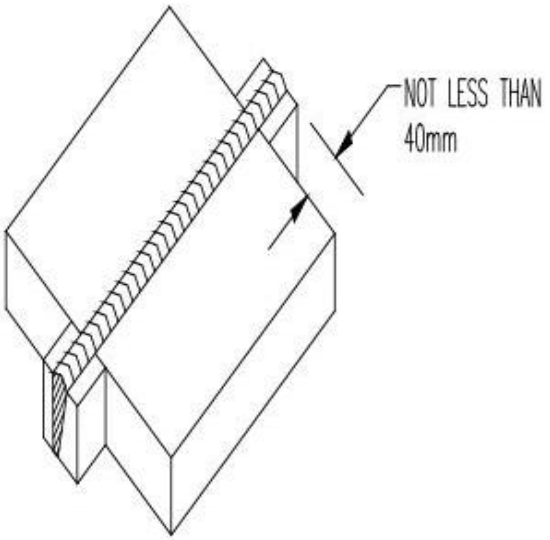


Butt Weld End Reinforcement
Fig. 9

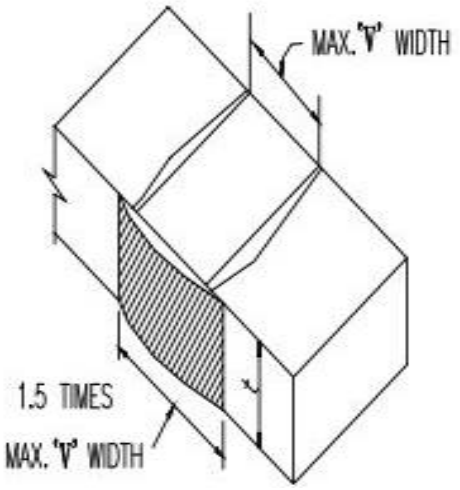
Fig. No. 8: Butt Welded T Joint



Butt Welded T Joint
Fig. 7

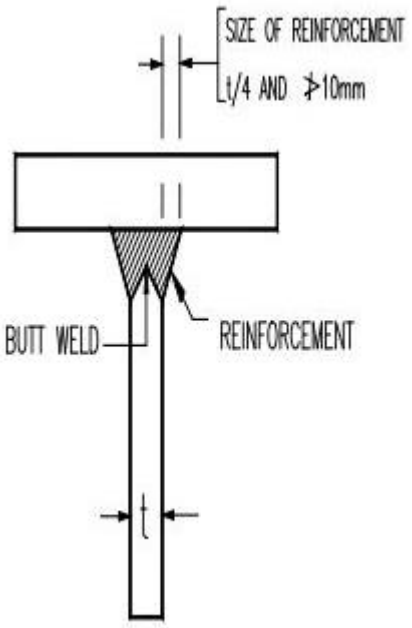


Butt Welded Joint with Run-On
and Run-Off Plates
Fig. 8

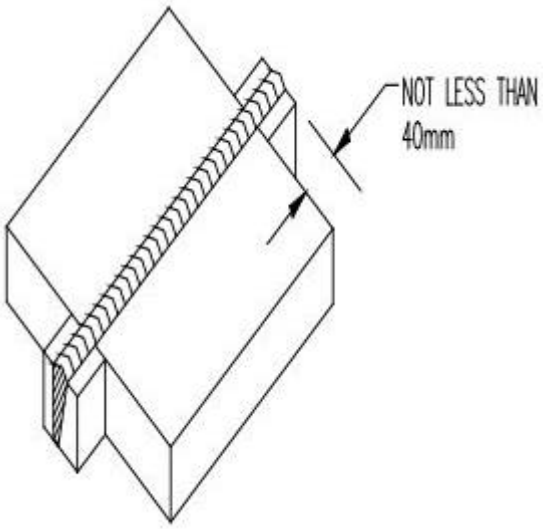


Butt Weld End Reinforcement
Fig. 9

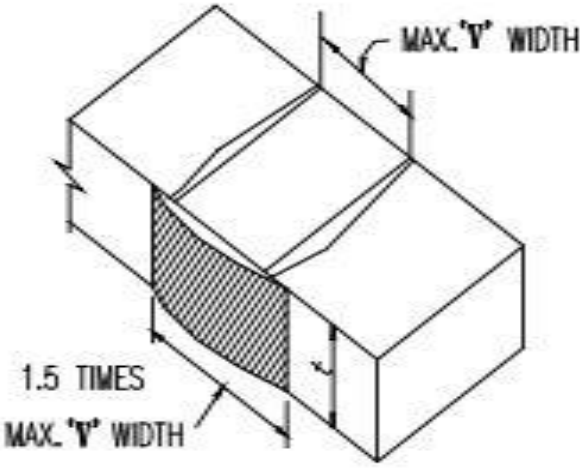
Fig. No. 9: Butt Welded Joint with Run On & Run Off Plates



Butt Welded T Joint
Fig. 7

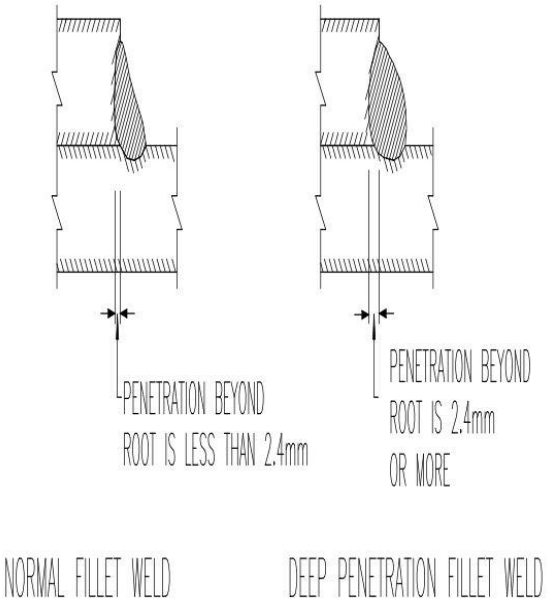


Butt Welded Joint with Run-On
and Run-Off Plates
Fig. 8

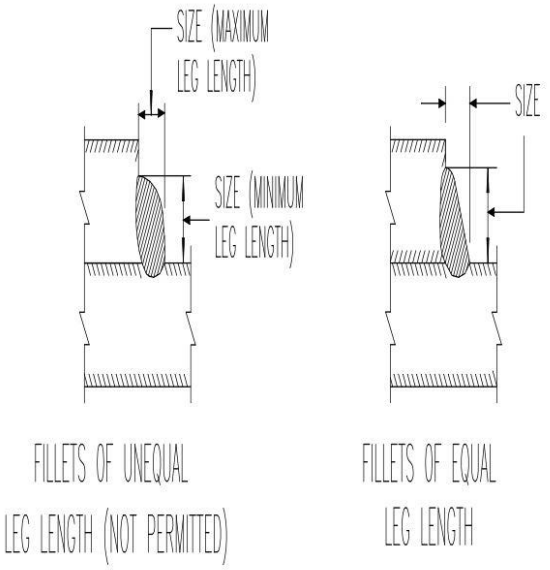


Butt Weld End Reinforcement
Fig. 9

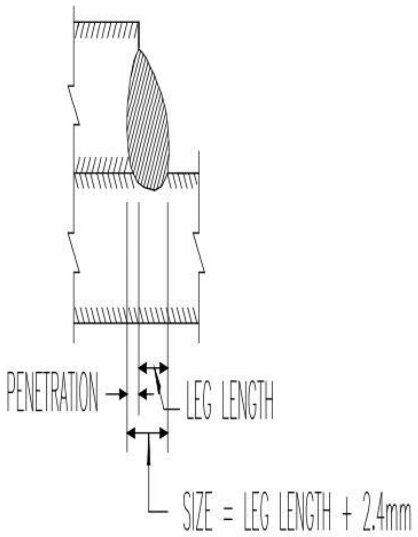
Fig. No. 10: Butt Weld End Reinforcement



Types of Fillet Weld
Fig. 10



Size of Normal Fillet Welds
Fig. 11



SIZE OF DEEP PENETRATION FILLET WELD

FIG.-12

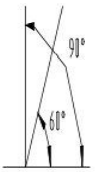
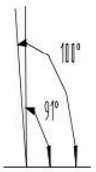
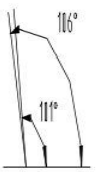
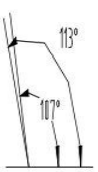
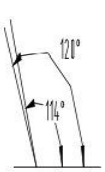
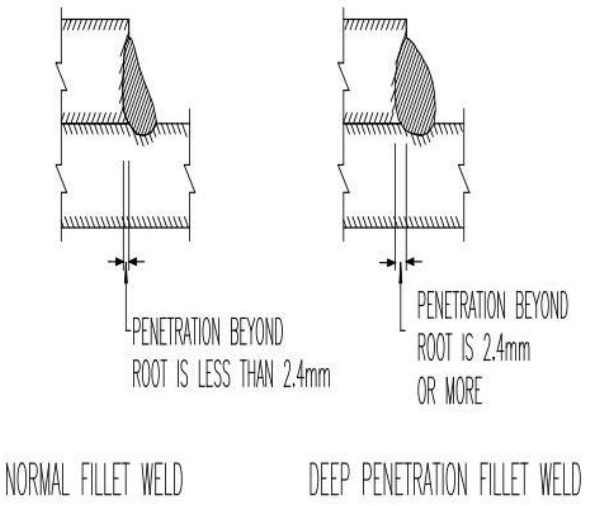
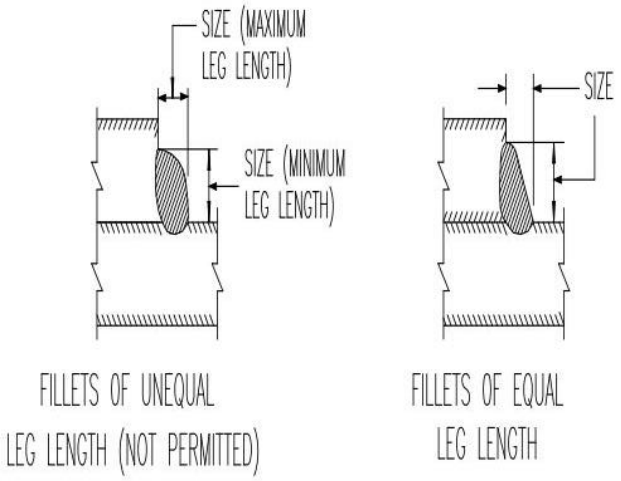
ANGLE BETWEEN FUSION FACES	60°–90°	91°–100°	101°–106°	107°–113°	114°–120°
					
CONSTANT 'K'	0.70	0.65	0.60	0.55	0.50

FIG.-13

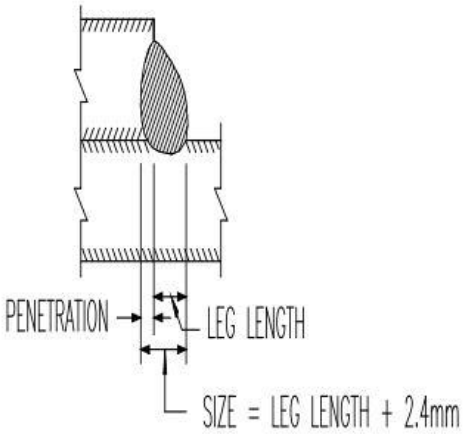
Fig. No. 11 Types of Fillet Weld



Types of Fillet Weld
Fig. 10



Size of Normal Fillet Welds
Fig. 11



SIZE OF DEEP PENETRATION FILLET WELD

FIG.-12

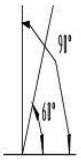
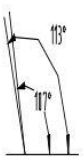
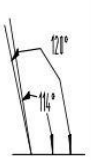
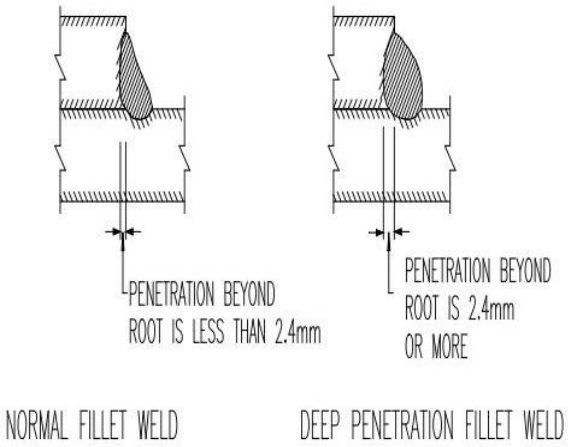
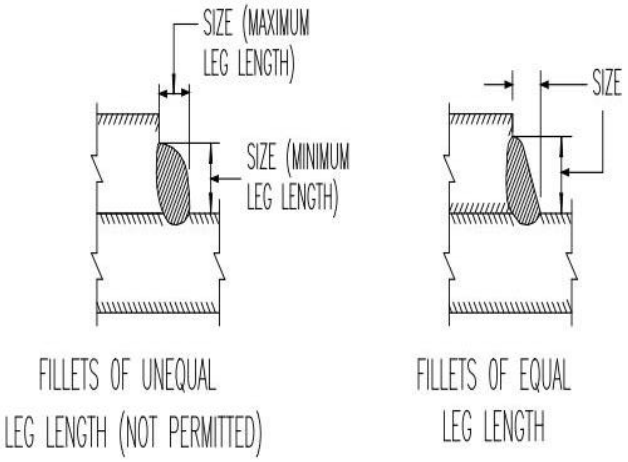
ANGLE BETWEEN FUSION FACES	60°-90°	91°-100°	101°-106°	107°-113°	114°-120°
					
CONSTANT 'K'	0.70	0.65	0.60	0.55	0.50

FIG.-13

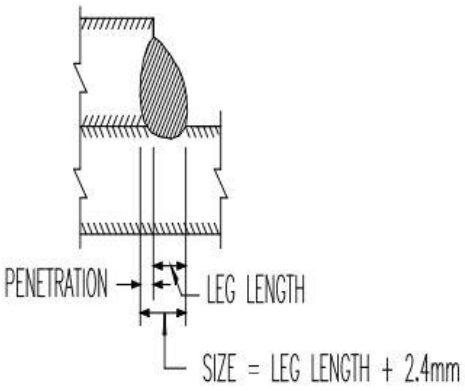
Fig. No. 12 Size of Normal Fillet Weld


PENETRATION BEYOND ROOT IS LESS THAN 2.4mm
PENETRATION BEYOND ROOT IS 2.4mm OR MORE
NORMAL FILLET WELD
DEEP PENETRATION FILLET WELD

Types of Fillet Weld
Fig. 10


SIZE (MAXIMUM LEG LENGTH)
SIZE (MINIMUM LEG LENGTH)
SIZE
FILLETS OF UNEQUAL LEG LENGTH (NOT PERMITTED)
FILLETS OF EQUAL LEG LENGTH

Size of Normal Fillet Welds
Fig. 11



SIZE OF DEEP PENETRATION FILLET WELD

FIG.-12

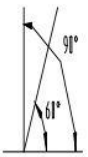
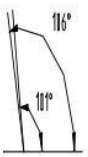
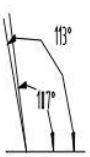
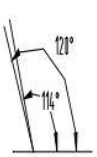
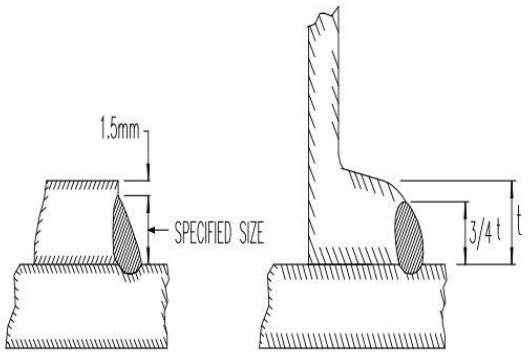
ANGLE BETWEEN FUSION FACES	60°-90°	91°-100°	101°-106°	107°-113°	114°-120°
					
CONSTANT 'K'	0.70	0.65	0.60	0.55	0.50

FIG.-13

Fig. No. 13 Size of Deep Penetration Fillet Weld



FILLET WELD APPLIED TO SQUARE
EDGE OF PLATE OR ROUND TOE OF ROLLED SECTION
FIG.-14

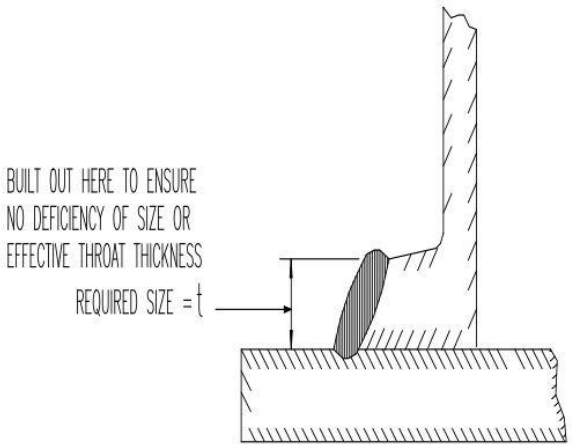
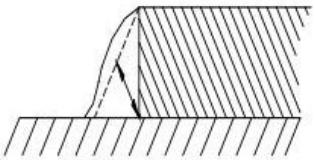
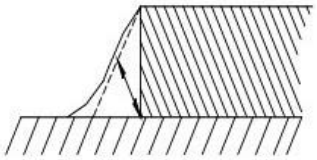


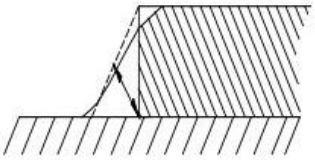
FIG.-15



(a) ACCEPTABLE - REQUIRED
THROAT THICKNESS OBTAINED

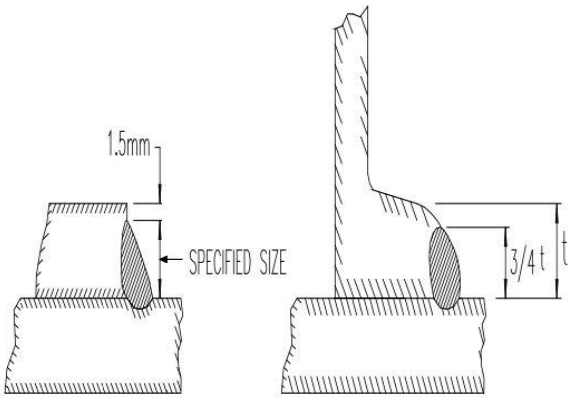


(b) ACCEPTABLE - REQUIRED
THROAT THICKNESS OBTAINED



(c) NOT ACCEPTABLE - REQUIRED
THROAT THICKNESS NOT OBTAINED

Fillet Weld Equal to the Size of Plate or Section
Fig. 16



FILLET WELD APPLIED TO SQUARE EDGE OF PLATE OR ROUND TOE OF ROLLED SECTION

FIG.-14

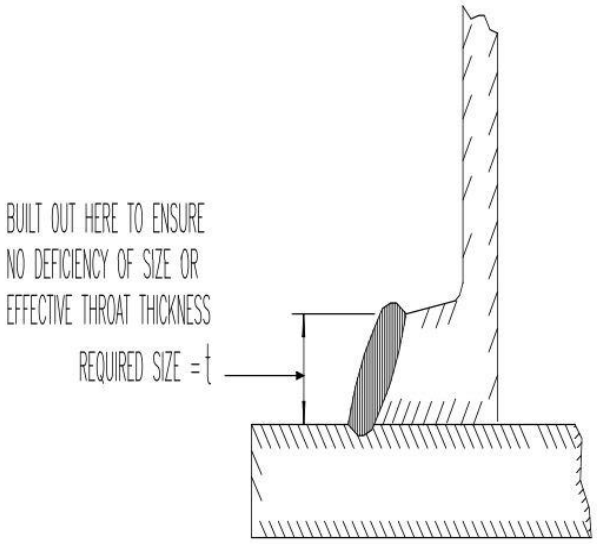
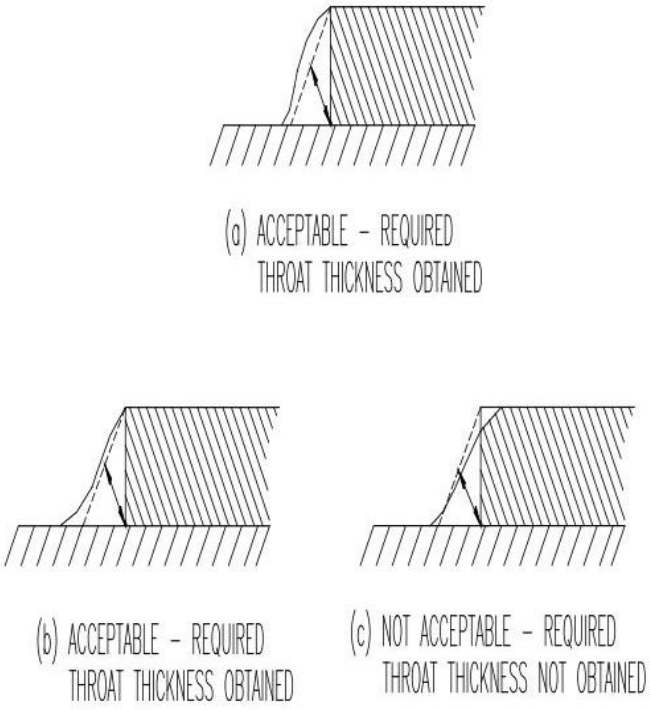
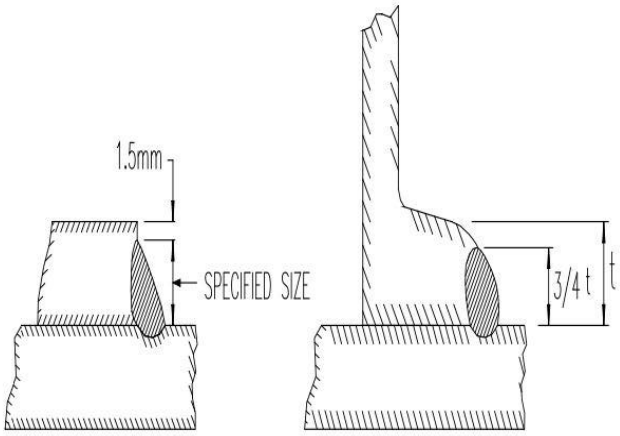


FIG.-15


(a) ACCEPTABLE - REQUIRED THROAT THICKNESS OBTAINED
(b) ACCEPTABLE - REQUIRED THROAT THICKNESS OBTAINED
(c) NOT ACCEPTABLE - REQUIRED THROAT THICKNESS NOT OBTAINED

Fillet Weld Equal to the Size of Plate or Section
Fig. 16



FILLET WELD APPLIED TO SQUARE EDGE OF PLATE OR ROUND TOE OF ROLLED SECTION

FIG.-14

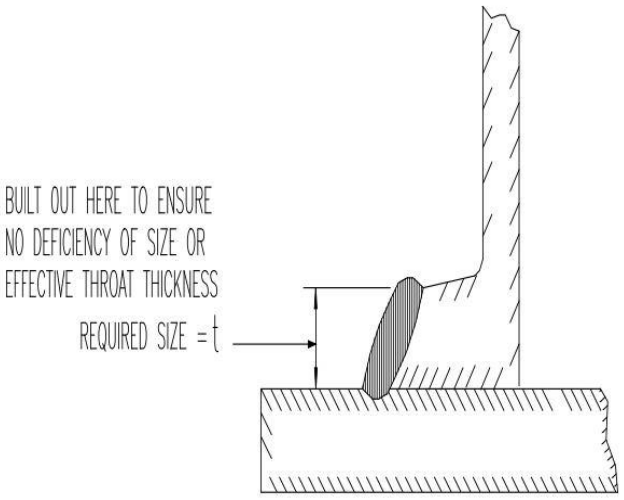
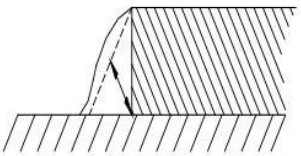
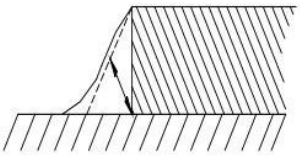


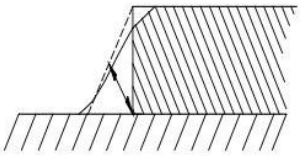
FIG.-15



(a) ACCEPTABLE - REQUIRED THROAT THICKNESS OBTAINED



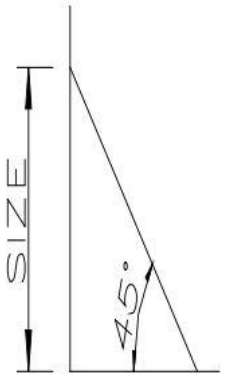
(b) ACCEPTABLE - REQUIRED THROAT THICKNESS OBTAINED



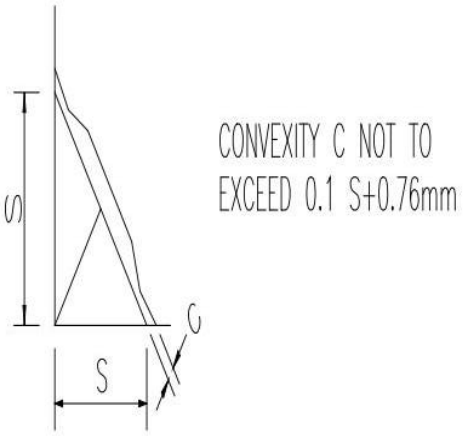
(c) NOT ACCEPTABLE - REQUIRED THROAT THICKNESS NOT OBTAINED

Fillet Weld Equal to the Size of Plate or Section
Fig. 16

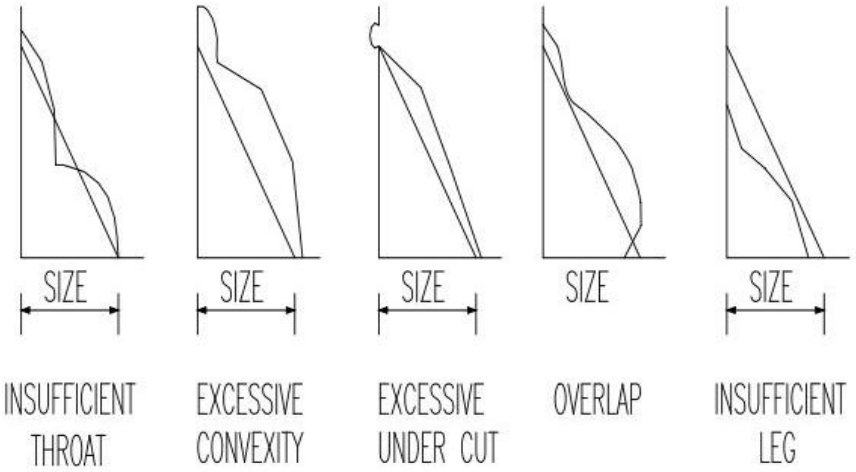
ACCEPTABLE AND DEFECTIVE WELD PROFILES



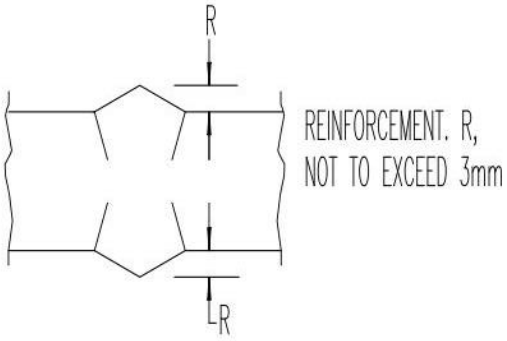
Desirable Fillet Weld Profile
Fig. 24



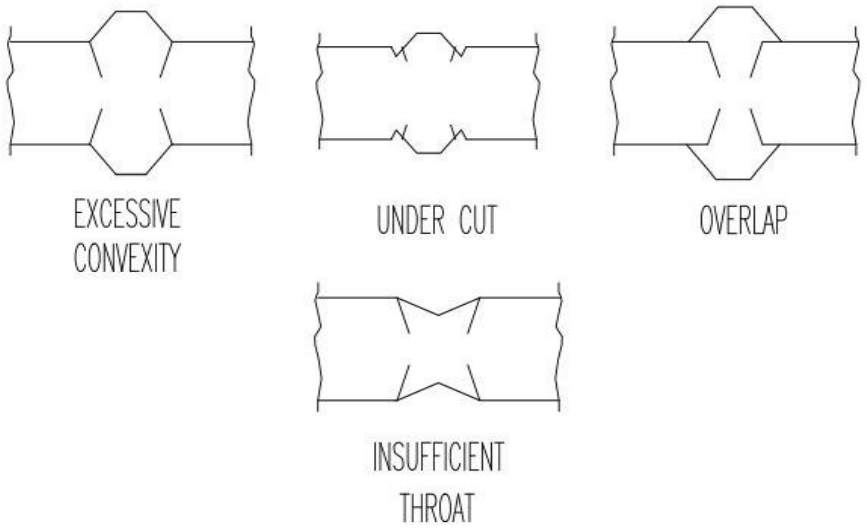
Acceptable Fillet Weld Profile
Fig. 25



Defective Fillet Weld profile
Fig. 26



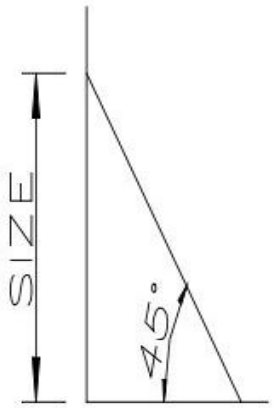
Acceptable Butt Weld Profile
Fig. 27



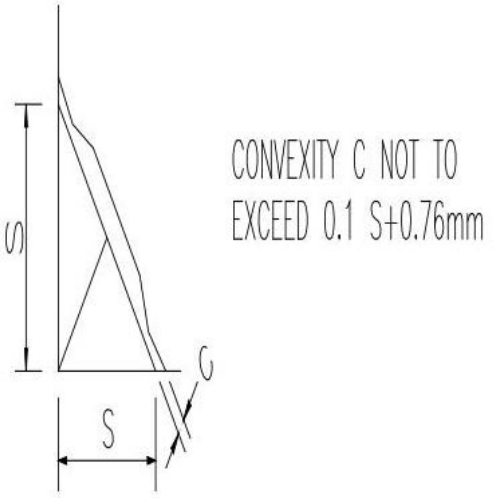
Defective Butt Weld profiles
Fig. 28

Fig. No. 17: Desirable weld Profile

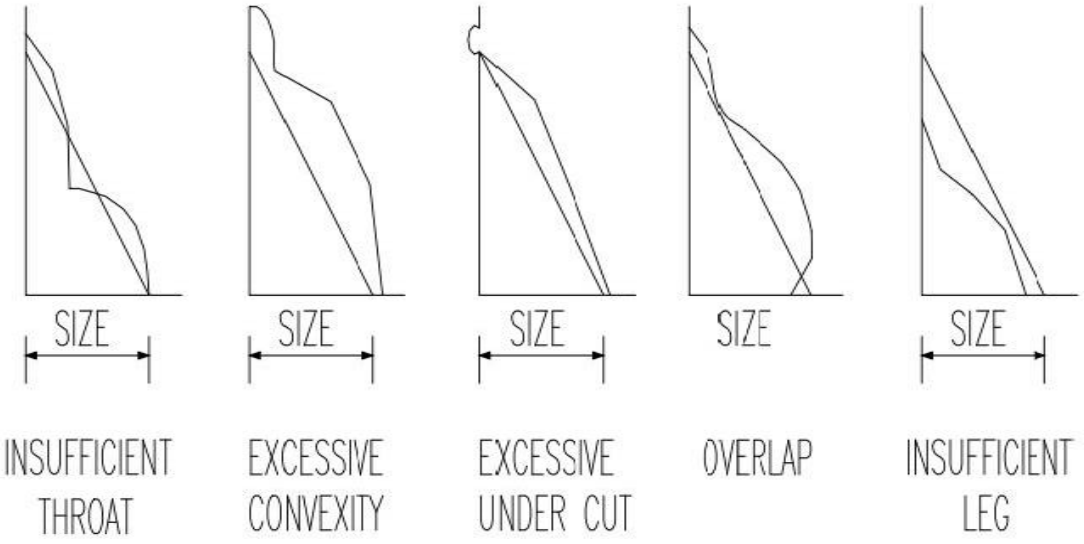
Acceptable and Defective Weld Profiles



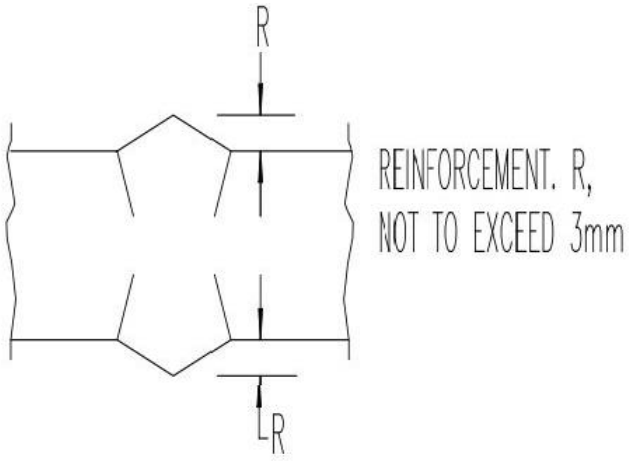
Desirable Fillet Weld profile
Fig. 24



Acceptable Fillet Weld profile
Fig. 25

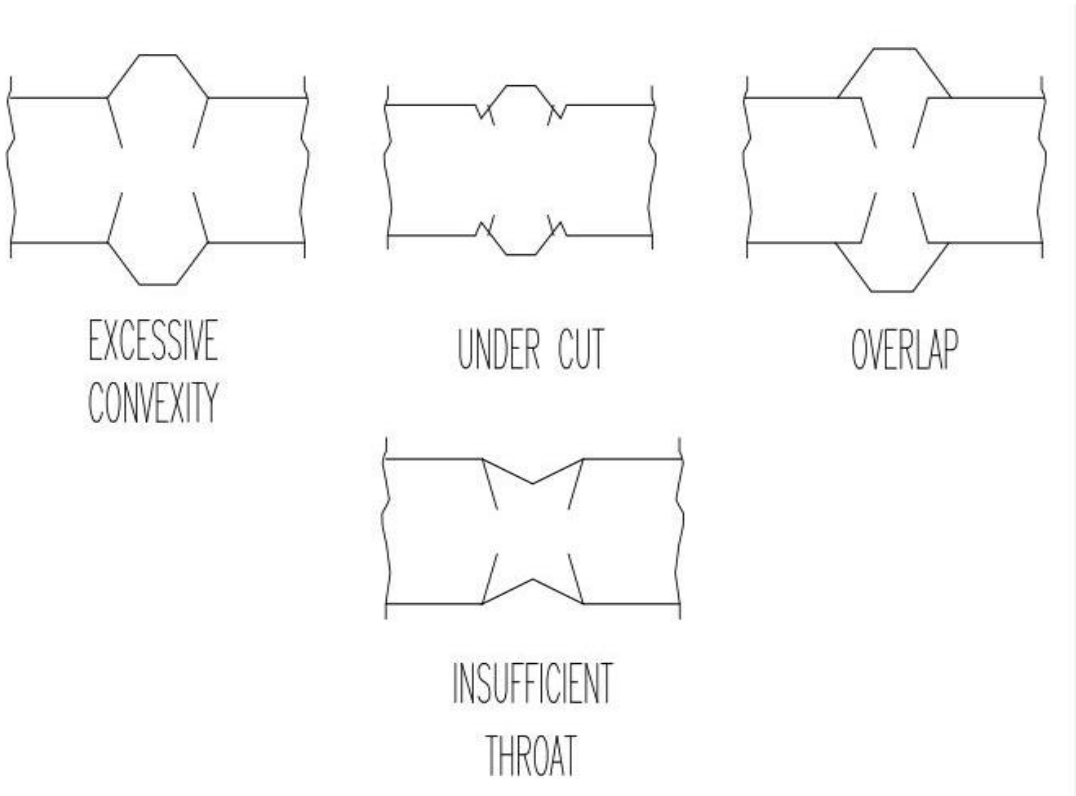


Defective Fillet Weld profile
Fig. 26



Acceptable Butt Weld Profile

Fig. 27

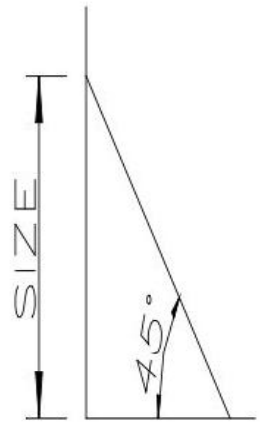


Defective Butt Weld Profile

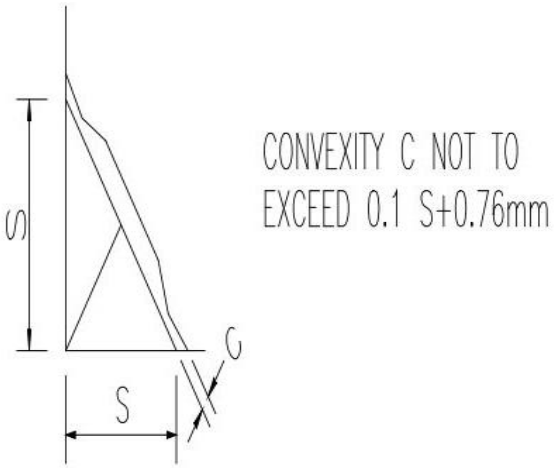
Fig. 28

Fig. No. 18: Acceptable weld profile

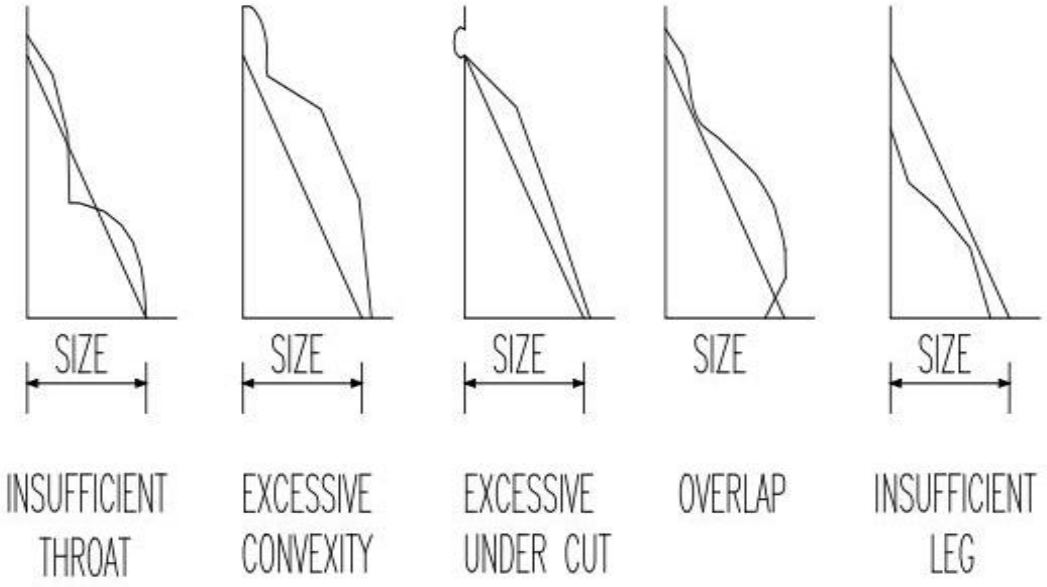
Acceptable and Defective Weld Profiles



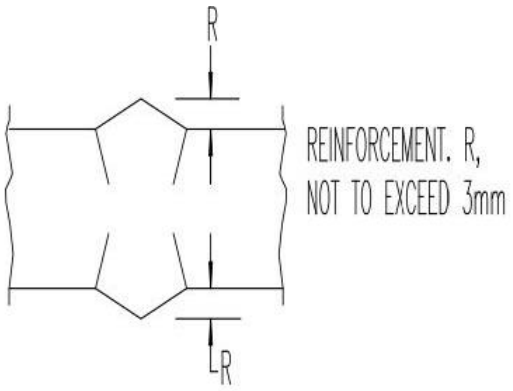
Desirable Fillet Weld Profile
Fig. 24



Acceptable Fillet Weld Profile
Fig. 25



Defective Fillet Weld Profile
Fig. 26



Acceptable Butt weld profile
Fig. 27

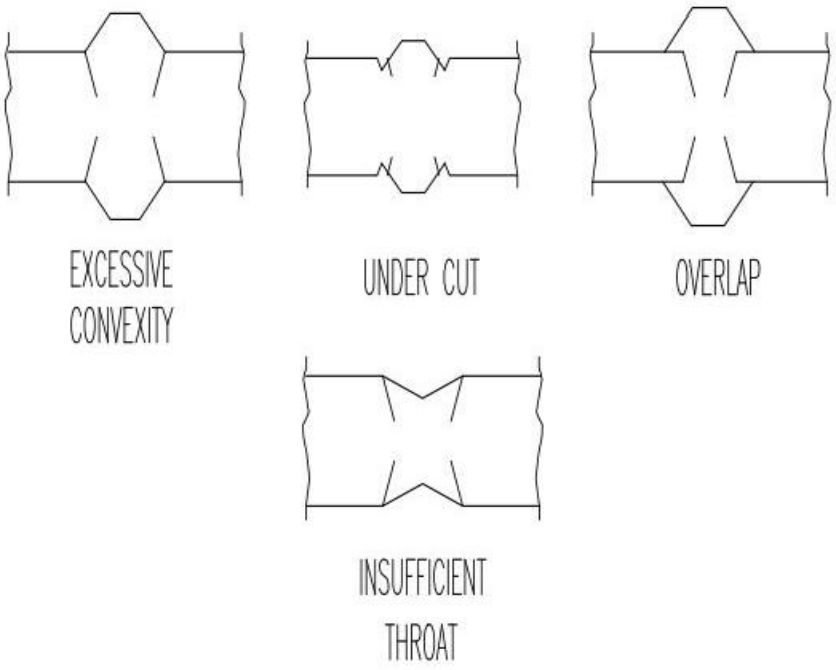
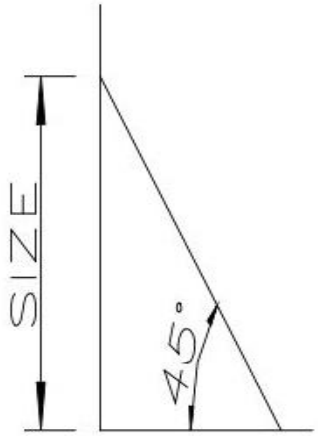
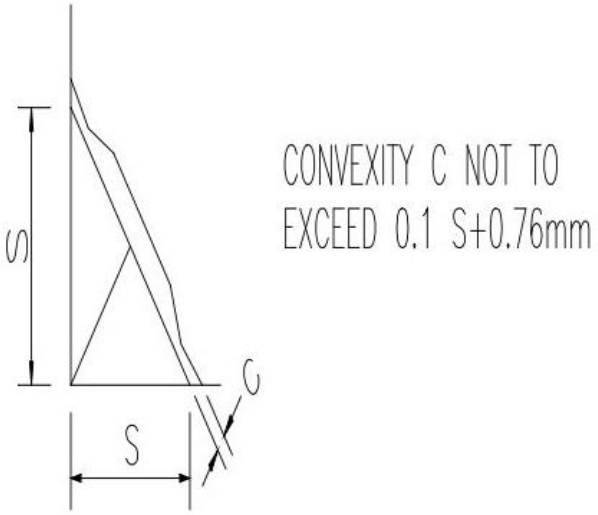


Fig. 28
Fig. No. 19: Defective fillet weld profile

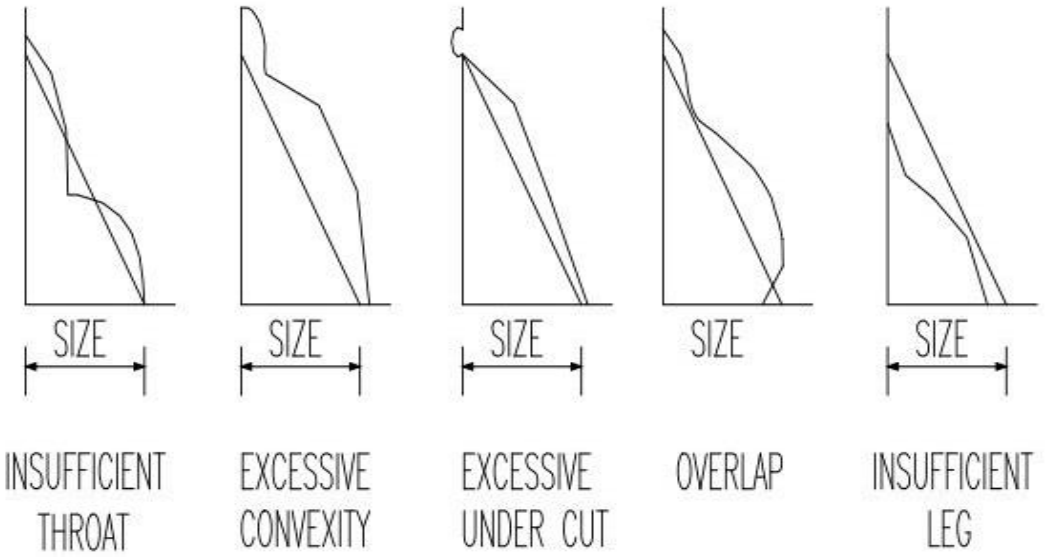
Acceptable and Defective Weld Profiles



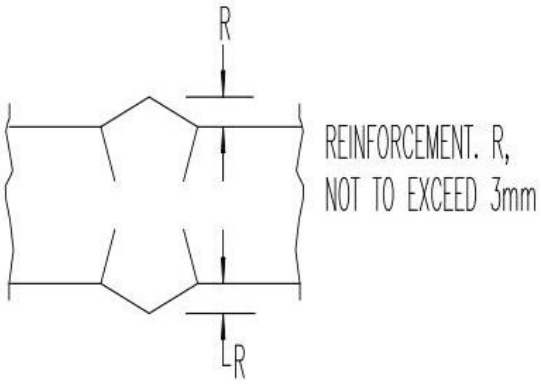
Desirable Fillet Weld Profile
Fig. 24



Acceptable Fillet Weld Profile
Fig. 25



Defective fillet weld profile
Fig. 26



Acceptable Butt weld profile
Fig. 27

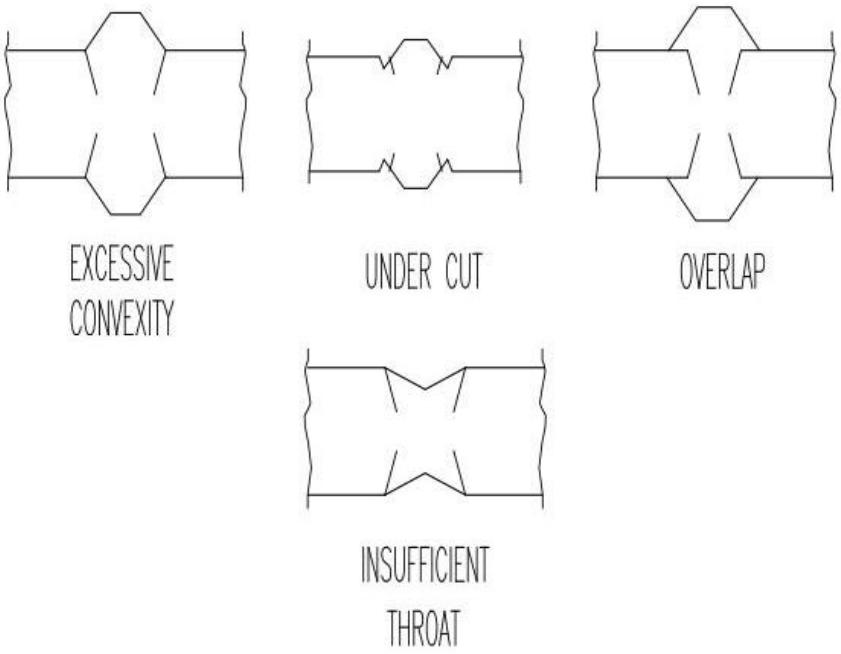
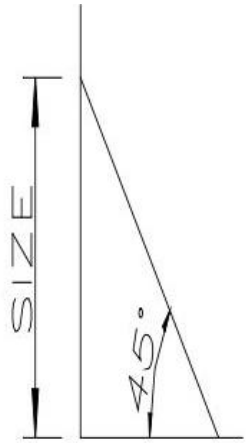
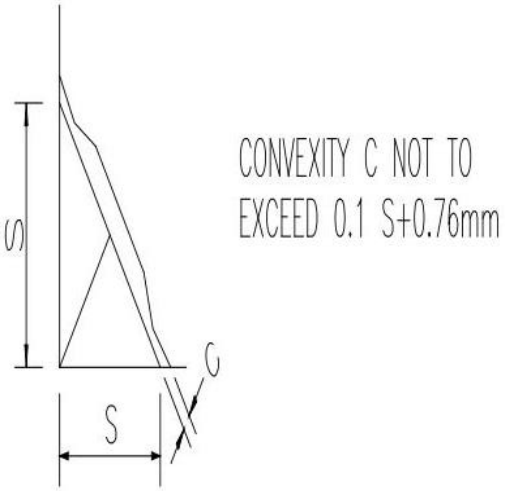


Fig. 28
Fig. No. 20: Acceptable fillet weld profile

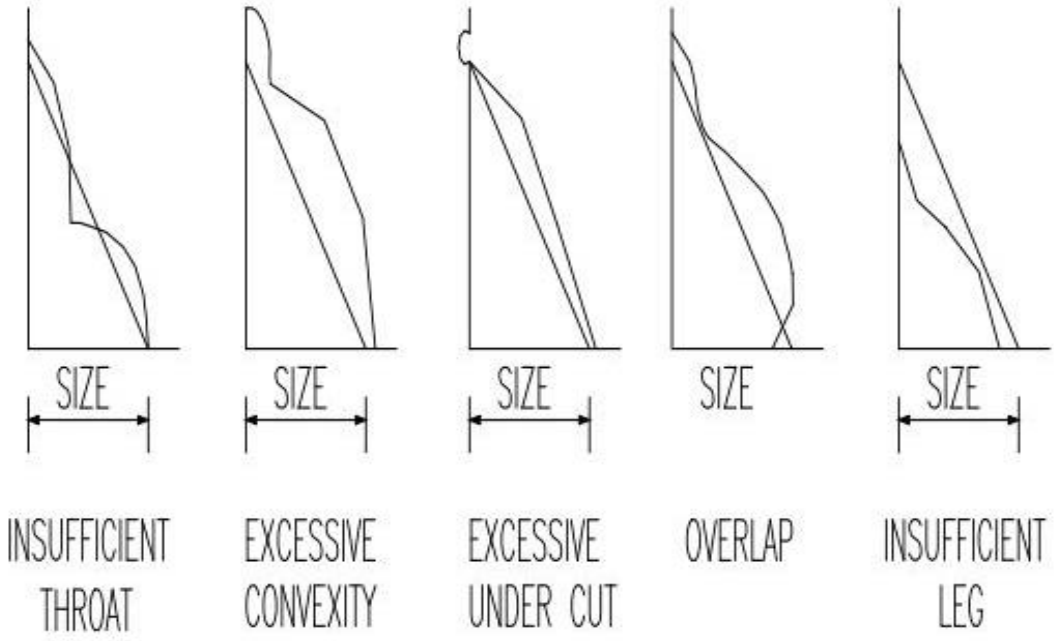
Acceptable and Defective Weld Profiles



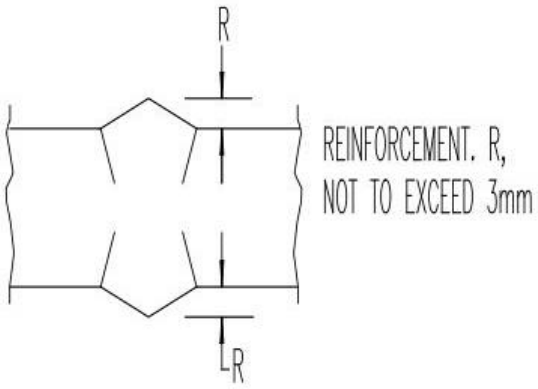
Desirable Fillet Weld Profile
Fig. 24



Acceptable Fillet Weld Profile
Fig. 25



Defective Fillet weld profile
Fig. 26



Acceptable butt weld profile
Fig. 27

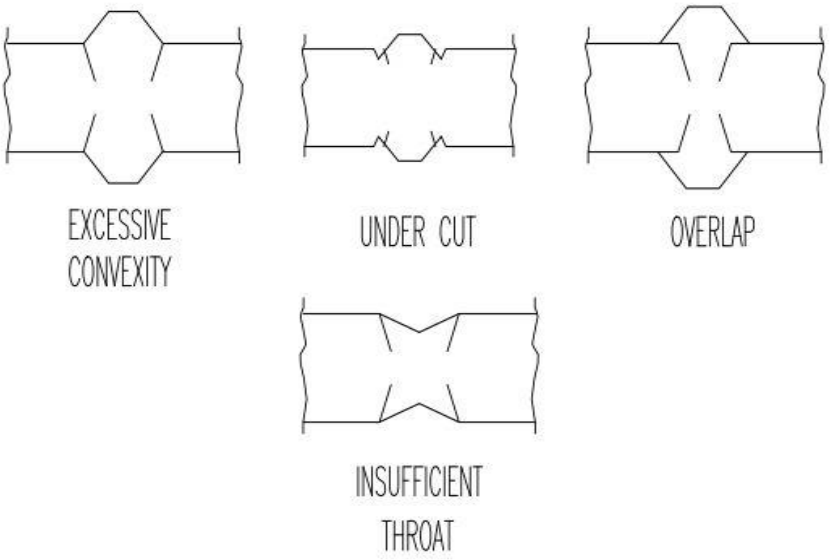
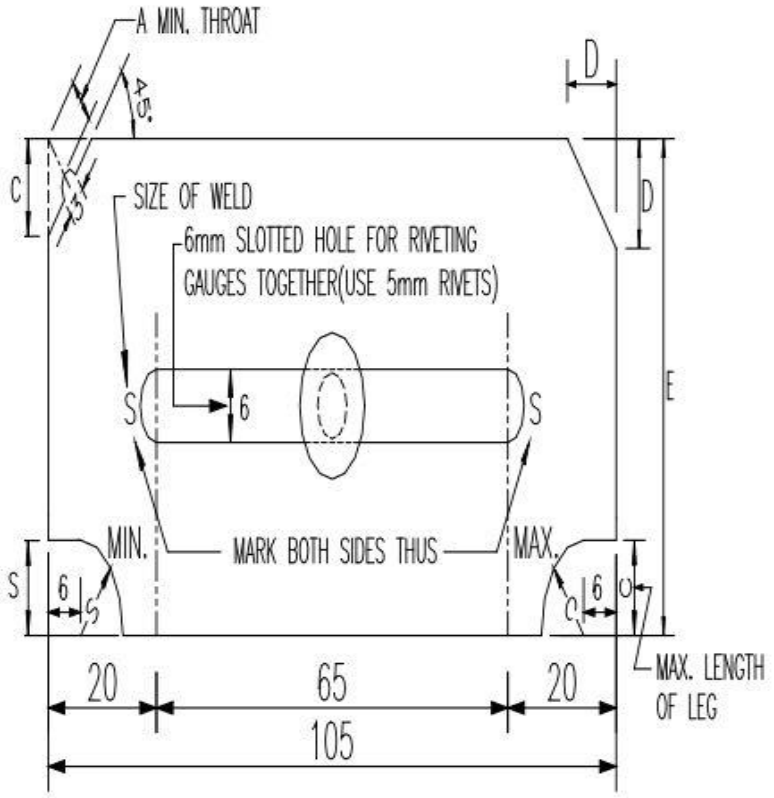


Fig. 28

Fig. No. 21: Defective butt weld profile

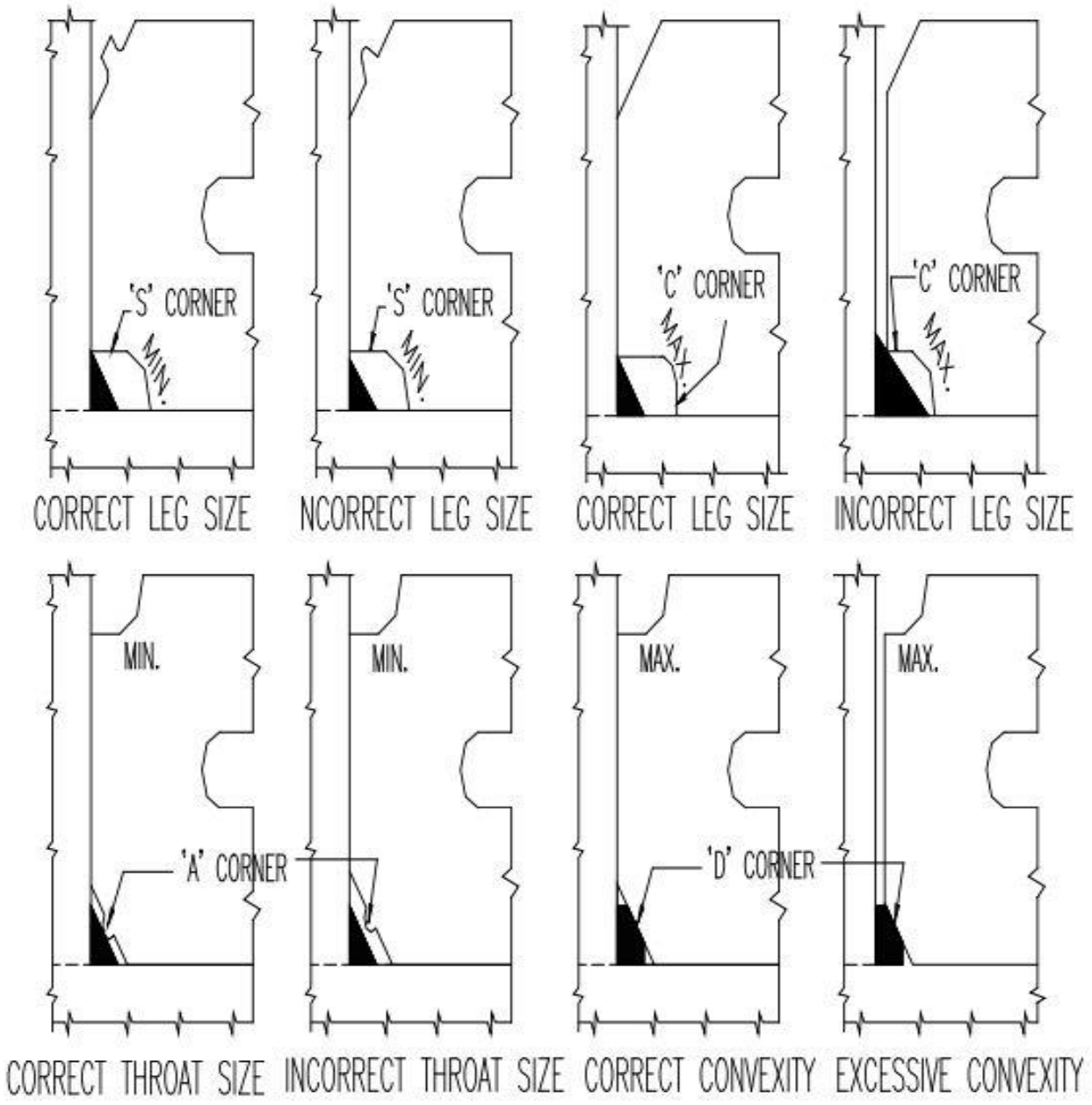
APPENDIX – B
(Ref. Cl 30.2)

FILLET WELD GAUGES AND THEIR APPLICATION



DIMENSION IN mm	WELD SIZE										
	5	6	8	10	12	14	16	18	20	22	25
A	3.5	4.2	5.7	7.1	8.5	9.9	11.3	13.9	14.2	15.6	17.5
S	5.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	22.0	25.0
C	6.0	7.0	9.0	11.0	13.0	15.0	17.0	19.0	21.0	24.0	26.0
D	6.7	7.8	10.3	12.4	14.8	17.2	19.3	21.6	23.7	26.3	30.3
E	40.0	40.0	40.0	50.0	50.0	50.0	50.0	50.0	65.0	65.0	65.0

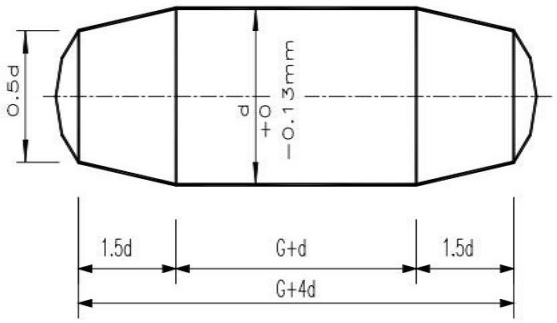
Method of Gauge application



1. All dimensions are in Millimeters.
2. Gauge for each weld size to be manufactured to the dimensions given in the table above.
3. Weld gauge size to be marked at location ‘s’ in 3mm letters. other marking in 2mm letters.
4. All markings to be done on both faces.
5. These gauges are suitable for inspection of normal fillet weld of sizes 5 to 25mm with angle between fusion face of 90^0 for deep penetration weld and for any other angle between fusion faces, special gauges may be made.

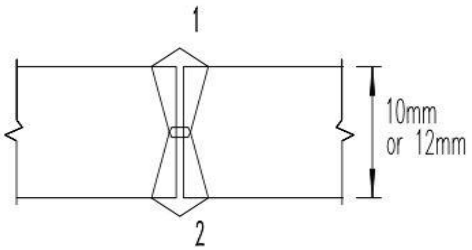
Fig. No. 22: Fillet weld gauge and their application

PARALLEL BARREL DRIFT

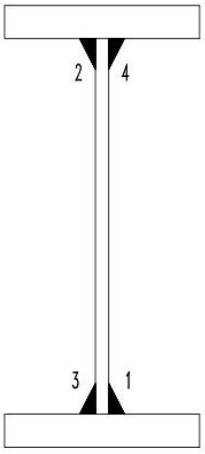


d. IS THE NOMINAL DIAMETER OF THE HOLE.
G. IS THE COMBINED THICKNESS OF THE METAL THROUGH WHICH THE DRIFT HAS TO PASS.
STEEL– IS: 1875 OR IS: 7283

Fig. 2
(Ref. Clause 19 & 20)



Sketch showing sequence of square butt welding



Sketch showing the sequence of fillet welding

for fabricating the I–section

Fig. 3
(Ref. Clause 27)

Fig. No. 23

TECHNICAL SPECIFICATIONS

1. PREAMBLE

1.1 The Technical Specifications contained herein shall be read in conjunction with the SPECIFICATIONS FOR ROAD AND BRIDGE WORKS (FIFTH REVISION) April 2013.

1.1.1 General

The Technical Specifications covering the materials and the workmanship aspects as well as method of measurements and payments are included in this section. These specifications cover the items of civil and non-civil works coming under scope of this document. All work shall be carried out in conformity with the same. These specifications are not intended to cover the minute details. The works shall be executed in accordance with good practices followed for achieving high standards of workmanship, thus ensuring safety and durability of the construction. All codes and standards referred to in these specifications shall be the latest thereof, unless otherwise stated.

1.1.2 Inclusive Documents

The provisions of General Conditions of Contract, those specified elsewhere in the tender document, as well as execution drawings and notes, or other specifications issued in writing by the Engineer shall form part of the Technical Specifications of this project.

1.1.3 The attention of the Contractor is drawn to those clauses of codes, which require supporting specification either by the Engineer or by mutual agreement between the supplier and purchaser. In such cases, it is the responsibility of the Contractor to seek clarification on any uncertainty and obtain prior approval of the Engineer before taking up the supply/construction.

1.1.4 Measurement and Payment

The methods of measurement and payment shall be as described under various items of the Specification and in the Bill of Quantities. Where specific definitions are not given, the methods described in BIS Code will be followed. Should there be any detail of constructionor materials which has not been referred to in the Specification or in the Drawings and Bill of Quantities but the necessity for which may be implied or inferred there from, or which isusual or essential to the completion of the work in the trades, the same shall be deemed to be included in the rates and prices entered by the contractor in the Bill of Quantities.

1.1.5 Defective Works

All defective works are liable to be demolished, rebuilt and defective materials replaced by the contractor at his own cost.

1.2 Site Information

1.2.1 The information given hereunder and provided elsewhere in these documents is given in goodfaith by the Employer but the Contractor shall satisfy himself regarding all aspects of site conditions and no claim will be entertained on the plea that the information supplied by the Employer is erroneous or insufficient.

1.2.2 General Climatic Conditions

1.2.2.1 The normal variation in temperature in this region is as under:

i) During summer months, the temperature rises up to 47° C.

ii) During winter months, the temperature falls up to 8.5° C.

1.2.2.2 The average annual rainfall is 1300 mm in the area.

1.2.3 Seismic Zone

The works are located in Zone II (Least Active Zone).

2. GENERAL REQUIREMENTS

The Technical Specifications in accordance with which the entire work described hereinafter shall be constructed and completed by the Contractor shall comprise of the following:

2.1 Part-I: General Technical Specifications

The General Technical Specifications shall be the "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS (Fifth Revision) April 2013" issued by the Ministry of Road Transport and Highways, Government of India and published by the Indian Roads Congress, henceforth called MORT&H Specifications and deemed to be bound into this document.

2.2 Part-II: Supplementary Technical Specifications

The Supplementary Technical Specifications shall comprise of various Amendments / Modifications / Additions to the "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS" referred to in Part-I above and Additional Specifications for particular item of work notalready covered in Part - I.

2.2.1 A particular clause or a part thereof in "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS (Fifth Revision) April 2013)" referred in Part-I above, where Amended/ Modified/ Added upon, and incorporated in Part-II, referred to above, such Amendment/Modification/ Addition supersedesthe relevant Clause or part of the Clause.

2.2.2 The Additional Specifications shall comprise of Specifications for particular item of works notalready covered in Part-I.

2.2.3 When an Amended/Modified/Added Clause supersedes a Clause or part thereof in the said Specifications, then any reference to the superseded Clause shall be deemed to refer to the Amended/Modified/Added Clause or part thereof.

2.2.4 In so far as Amended / Modified / Added Clause may come in conflict or be inconsistent with any of the provisions of the said MORT&H Specifications under reference, the Amended / Modified / Added Clause shall always prevail.

2.2.5 The following Clauses in the "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS (Fifth Revision) April 2013" have been Amended/Modified/Added upon:

Sl.	Section No.	Section Title	Clause No.
1.	100	General	102, 103, 106, 107, 108,109, 111, 112, 114 and 120
2.	200	Site Clearance	201
3.	300	Earthwork, Erosion Control and Drainage	301, 305 and 306
4.	400	Sub-bases, Bases (Non-Bituminous) and Shoulders	401 and 406
5.	500	Bases and Surface Courses (Bituminous)	501, 502, 503, 505 and 507
6.	800	Traffic signs, Markings and other Road Appurtenances	803, 806, 807 and 811
7.	900	Quality Control for Road works	903
8.	1000	Materials for Structures	1006, 1007,1008, 1009, 1010
9.	1100	Pile Foundations	1101, 1103
10.	1500	Form Work	1501, 1503, 1504, 1506, 1508
11.	1600	Steel Reinforcement	1602, 1604, 1605, 1606
12.	1700	Structural Concrete	1707 and 1716.
13.	1900	Structural Steel	1903
14.	2100	Open Foundations	2104, 2106
15.	2200	Substructure	2204 and 2210
16.	2700	Wearing Coat and Appurtenances	2702
17.	2900	Pipe Culverts	2911
18.	3000	Maintenance of Road	3001
19.	3100	Reinforced Soil	3102, 3103, 3105

2.2.6 Additional Specifications

The Clauses A-1 to A-5 have been added to the "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS".

CLAUSE A-1 : ADDITIONAL SPECIFICATION FOR FLY ASH AND SAND MIX FOR SUBGRADE FILL MATERIAL

CLAUSE A-2 : ADDITIONAL SPECIFICATIONS FOR MAINTENANCE OF RIGHT OF

WAY**CLAUSE A-3 :** ADDITIONAL SPECIFICATION FOR GEOTECHNICAL INVESTIGATION

CLAUSE A-4 : VOID FORMER

CLAUSE A-5 : PVC DOWNTAKE PIPE

CLAUSE A-6 : TEMPORARY BARRICADE

In the absence of any definite provisions on any particular issue in the aforesaid Specifications, reference may be made to the latest codes and specifications of IRC, BIS, BS, ASTM and AASHTO in that order. Where even these are silent, the construction and completion of the works shall conform to sound engineering practice as approved by the Engineer.

2.3 The latest edition till 60 (sixty) days before the final date of submission of the bid of all Specifications /Standard shall be applicable.

PART II

SUPPLEMENTARY TECHNICAL SPECIFICATIONS

(AMENDMENTS / MODIFICATIONS / ADDITIONS TO EXISTING CLAUSES OF GENERAL TECHNICAL SPECIFICATIONS)

SECTION 100 GENERAL

CLAUSE 102 DEFINITIONS

The following abbreviations shall be added in this Clause:

"MORT&H"	: Ministry of Road Transport & Highways (Previously known as „MOST", Ministry of Surface Transport).
"WBM"	: Water Bound Macadam.
"WMM"	: Wet Mix Macadam
"CPCB"	: Central Pollution Control Board
"CECRI"	: Central Electro Chemical Research Institute
"MDD"	: Maximum Dry Density (as per IS: 2720 – Part 8)
"RM"	: Running Meter
"VG"	: Viscosity Grade
"QA"	: Quality Assurance

CLAUSE 103 Add at the end of the clause

The latest edition of these standards till 60 (sixty) days before the final date of submission of the tender shall be adopted.

CLAUSE 106 CONSTRUCTION EQUIPMENT

Add the following at the end of sub-para (k)

No equipment used in the work shall be more than 7 years old.

CLAUSE 107 DRAWINGS

Clause 107.2 Add the following at the end of para

The fabrication drawings and erection/launching scheme (along with design calculations) for the girders for ROB and major bridges shall also be prepared by the contractor and submit to the Engineer for approval prior to the commencement of construction.

For ROBs, as required by the Railway Authority, Contractor shall prepare fabrication, erection, launching scheme drawing in compliance to the requirements of the concerned zonal railways, modify and incorporate comments of the railways and procure approval in consultation with and under the direction of the Engineer.

CLAUSE 108 SITE INFORMATION

Clause 108.4 (New Clause) Add the following:

The Contractor shall identify the source of sand, quarries for aggregates, borrow areas and other sources of materials required for the work. He shall satisfy himself that the required materials are available in adequate quantities and are complying with the requirements of the Specifications. He shall also satisfy himself about the availability of materials during the monsoon and make adequate arrangements for proper stacking so as to maintain the construction schedule. No claims shall be entertained on account of non-availability of materials and increase in leads.

It is the sole responsibility of the contractor to arrange the quarries, borrow areas etc. on license / lease basis or otherwise and study in detail the scope of taking the quarry on lease if required. Advance information must be collected by the contractor regarding the procedure laid down and the consequent delay in arranging the quarries on lease and he must make alternative arrangement to procure the quarry products from lease holders. No separate payment will be made for arranging such quarries, borrow areas. The Quarries & borrow areas shall be demarked & approved by the Engineer before use in the work. The contractor must satisfy himself about the rates towards royalty charges to be deposited for all the borrowed and quarry materials including fly ash if applicable.

CLAUSE 109 SETTING OUT

Clause 109.1 Add the following para in the Clause 109.1

The contractor shall provide the necessary surveying equipment, accessories, and surveyors and labours required for setting out and related measurements, including making available these tothe engineer and his representatives at different stages of the work. Contractor shall be responsible for providing precision survey instruments for setting out the work. The surveyingequipment shall be approved by the engineer, be in good working condition inadequate numbers and shall include, inter-alia, the following:

i. Digital level with tripods and levelling staff reading to 5mm accuracy by direct observation and to 1mm accuracy by estimation or better.

ii. Digital level with tripods and levelling staff reading to 5mm accuracy by direct observation and to 1mm accuracy by estimation or better.

iii. Total station with 2 spare batteries and a charger, three tripods plus tangents sufficient for a 4 km range, together with an electronic data recorder, 6 data packs and all necessary software for operation.

iv. Precision staff.

v. 3-meter straight edge and measuring wedge fitted with handles wedges 100 mm ht. And 1 mm accuracy.

vi. Field Umbrellas

vii. Ranging rods 50 mm dia 3 m long straight with one end each metallic conical and painted alternatively black and white along the length.

viii. Camber Templates 3 lane fitted with handles.
ix. Steel tape graduated in meters, centimeter and millimeter
a) 10 m long
b) 20 m long
c) 50 m long
d) Reference markers and pegs

The Contractor shall maintain the surveying equipment in good condition during the full duration of works and replace the ones, which get worn out or otherwise become unworkable.

The survey equipment will be calibrated against its accuracy time to time.

CLAUSE 111 PRECAUTIONS FOR SAFEGUARDING THE ENVIRONMENT

Clause 111.3 Quarry Operations

Add the following:

Contractor shall ensure scheduling the movement of transport carrying material to and from site during non-peak hours. The trucks carrying dusty material sand / fly ash shall be covered with tar Pauline and provided with adequate free board to prevent spillage. End boards shall be provided in loaders to prevent spillage. Stockpiling of material shall be properly planned so as to ensure that no traffic jam takes place on the project corridor.

Water tankers with suitable sprinkling system shall be deployed along the haulage roads and in the work sites. Water shall be sprinkled regularly all along the routes to suppress airborne dusts from truck/dumper movements particularly on unpaved roads. Actual frequency will be agreed with the Engineer to suit site conditions."

Clause 111.10 Control and Disposal of Wastes

Add the followings at the end of the sub - Clause:
Spilling of oil and bituminous products during construction and transport shall be avoided to reduce the chances of contamination of surface as well as ground water.
Degraded materials shall be disposed of in a manner as approved by the Engineer and wastewater shall be disposed into septic tanks and soak pits etc. The Contractor shall make arrangements to cleanup spoil as soon as the work finishes in a stretch. If such sites are located outside the ROW, restoration of the site to a level acceptable to the land owner(s) will be carried out within a time period agreed between landowner(s) and the Contractor. Separators shall be used to separate POL materials from wastewater prior to discharging to the watercourses or as approved by the Engineer in conformance with directives and guidelines.

CLAUSE 112 ARRANGEMENT FOR TRAFFIC DURING CONSTRUCTION

Clause 112.1 General

Replace the following at 3rd sentence of 1st para:

"Two weeks before undertaking work which would involve any obstruction whatsoever to traffic, the Contractor shall submit, for the Engineer's approval, a Traffic Control Plan.

CLAUSE 114 SCOPE OF RATES FOR DIFFERENT ITEMS OF WORK

Clause 114.2 Add the followings at the end of sub-Clause ii):

The Contractor shall submit data via electronic media to the Engineer in a form readily compatible with Engineer's planning system.

Monthly progress report will be submitted in a format acceptable to the Engineer. The report shall state the progress which has been achieved compared with the planned progress, illustrate delays in proportion to the progress planned, analyze the consequences and state planned corrective measures. Intermediate progress reports may also be required.

The first issue of the detailed construction programme including the detailed description of the system and the procedures shall be submitted to the Engineer for acceptance not later than 28 days after the date of receipt of the letter of acceptance.

The contractor shall submit to the Engineer for approval the updated & revised programme at every three months interval or as such as directed by the Engineer. The updated & revised programme shall be submitted showing the actual progress achieved (physical & financial) and the effects of the progress achieved on the timing of the remaining work including any change to the sequence of the activities.

Clause 114.4 (New Clause)

If any work executed by the Contractor does not meet the specifications, it shall be as rejected.

Clause 120 FIELD LABORATORY

Add the followings after sub-Clause 120.2

The laboratory set-up must be complete including a set of reference standards, adequately staffedand operational to the satisfaction of the Engineer not later than 1 month from the date of receiptof Notice to commence the works.

The Contractor shall be responsible for the provision of adequately experienced and qualified laboratory staff, in sufficient numbers to be able to meet all testing requirements to the approval of the Engineer and for the supply of all transportation of staff, testing equipment and samples necessary to allow the testing to be performed in a time scale compatible with the needs of the Site.

Contractor shall arrange to maintain the laboratory in satisfactory manner and will carry stocks of spare equipment and laboratory consumables until the issue of Taking Over Certificate.

In addition to the above, the Contractor shall arrange any other equipment for carrying out testing required for quality control as per the Specifications.

Clause 120.5 Rate

Replace the para with the followings;

Construction of laboratory in the land arranged by contractor, equipment and instruments, calibration etc. and maintenance of laboratory including reagents and consumables shall be payable as per provision in the BOQ. Equipment and instruments shall be property of contractor.

SECTION 200 SITE CLEARANCE

CLAUSE 201 CLEARING AND GRUBBING

Clause 201.1 Scope

Substitute the following at the last sentence

Clearing and grubbing shall be performed less than two weeks in advance of earthwork operation and in accordance with requirement of these specifications.

SECTION 300 EARTHWORK, EROSION CONTROL AND DRAINAGE

CLAUSE 301 EXCAVATION FOR ROADWAY AND DRAINS

Clause 301.1 Scope

Add the following as second paragraph under this clause:

"The work shall also include excavation for canal training at culverts/bridges, excavation of existing shoulders and medians for purposes of widening the pavement and excavation of existing embankment for reconstruction to specification."

Clause 301.3.3 Excavation – General

The following paragraph is added to the sub-clause 301.3.3

"Temporary support to the sides of the excavation, necessary to support the foundation of adjoining structures and to prevent any ground movement shall be provided by the Contractor. Where temporary supports are provided these shall be designed & removed such that no ground movement occurs on removal. The Contractor shall submit his proposal in this respect to the Engineer for approval prior to commencement of the excavation".

Clause 301.3.5 Rock Excavation

The first sentence of first para shall read "Rock, when encountered in road excavation shall beremoved up to a level of 100mm below the base of WMM".

Clause 301.3.11 Disposal of excavated materials

Delete this Clause and replace with:

"All the excavated materials shall be the property of the employer. Suitable material obtained from the excavation of the roadway, shoulders, verges, drain, cross drainage works, etc. shall be used for:

i) Filling for roadway embankments, with all lifts and leads.

ii) Filling existing pits in the right of way as directed by the Engineer, including levellingand spreading, with all lifts and leads.

iii) For landscaping of the road as directed by the Engineer, including levelling andspreading, with all lifts and leads.

Excavated rock, if found suitable, shall also be available to the contractor for converting into aggregates and other item of works after taking prior approval of the Engineer and affording due credit in his bid proposal. Royalty for the quantity consumed shall be deposited with the concerned state government department.

Unsuitable and surplus material not intended for use shall be transported with all lifts and lead, disposed off or used as directed by the engineer. No place will be made available by the employer for disposing off the material and no claim will be entertained on that account.

Clause 301.6 Preparation of Cut Formation

Third para shall be read as under:

"In rock formation, either in full width or partial width, the rock shall be cut 100mm below the specified elevation of base WMM and the surface irregularities shall be corrected with granular material. The unsuitable material shall be disposed of in accordance with Clause 301.3.11".

CLAUSE 305 EMBANKMENT CONSTRUCTION

Clause 305.2 Material and General Requirements

Clause 305.2.1 Physical Requirements:

Clause 305.2.1.5 Add the following in the table:

Table 300-1
Density Requirements of Embankment and Subgrade Materials

SN.	Type of Work	Maximum laboratory dry unit weightwhen tested as per IS-2720(Part 8)
4)	Embankments with fly ash with earth cover on sides.	Not less than 11.5 KN/cum (for fly ash only)
5)	Embankment with fly ash with earth cover for embankment	Not less than 16.0 KN/cum (for soil only)
6)	Subgrade with fly ash and sand mix	Not less than 13.5 KN/cum (for fly ash& sand mix)
7)	Expansive clays	Not allowed

2.2.4 Compaction Requirements
Delete Table 300-2 and substitute the following:

Table 300-2
Compaction Requirement of Embankment and Sub grade

SN.	Type of Work/ Material	Relative Compaction as % age of maximum laboratory dry density as per IS-2720 (Part 8)
1	Subgrade and earthen shoulders	Not less than 97%
2	Embankment	Not less than 95%
3	High Embankment (Height >6m)	Not less than 97%
4	Expansive clays	Not allowed
5	Design CBR of Subgrade & Shoulder for the widened portion and new carriageway shall be as per drawing, but not **less than 8%.**	

New Clause 305.2.2.5 Pond Ash / Fly Ash as fill material

Pond ash / fly ash can be used as fill material for embankment and in mix with coarse sand as subgrade fill. The sides of the fill shall be covered with borrowed soil having PI values more than 12 but less than 20 to prevent erosion of the fill material. It shall be ensured that the fill material is not deposited in saturated condition. Compaction shall be carried out to minimum 97% of the maximum dry density at optimum moisture content.

The properties of the pond ash/fly ash to be used as fill material shall have the following characteristics:

Table 300-3

Properties of Ash for Fill Materials

SN	Parameters	Range
1	Specific Gravity	1.90 – 2.55
2	Plasticity	NP
3	MDD (gm/cc)	1.15 - 1.25
4	OMC (%)	18.0 – 26.0
5	Cohesion (kg/cm2)	0.0 -0.05
6	Angle of Internal Friction (φ)	30.00 – 35.00
7	Coefficient of consolidation, Cv, (cm2/sec)	1.75x10- 3 –1.90x10- 3
8	Compression index, Cc	0.05 – 0.1
9	Permeability (cm/sec)	7x10-5 – 5x10-3
10	Particle Size Distribution Clay size fraction Silt size fraction Sand size fraction Gravel size fraction	0.0 – 5.0 8.0 – 65.0 10.0 – 90.0 0.0 – 5.0
11	Coefficient of uniformity	3.1 – 10.5

Construction of Embankment using Pond ash/fly ash shall be carried out complete as per IRC: SP: 58-2001 as applicable. For subgrade fill, the pond ash/fly ash shall be mixed with sand (zone II / III, IS:383) in suitable proportion to achieve the dry unit weight given in

Table 300-1. Minimum sand content in the mix shall not be less than 30% by weight of the totalmix in any case.

Clause 305.3 Construction Operations

Clause 305.3.6Compaction

Insert the following sentence before the last sentence of Paragraph 4.

"The co-relation between sand replacement densities and nuclear gauge densities shall be based on trials with minimum 30 coherent density measurements".

CLAUSE 306 SOIL EROSION AND SEDIMENTATION CONTROL

Clause 306.4 Measurements for Payment

Substitute Clause 306.4 as follows:

"All temporary sedimentation and pollution control works shall be deemed as incidental to the earthwork and other items of work and as such no separate payment shall be made for the same."

Clause 306.5 Rates

This clause shall be deleted.

SECTION 400 SUB-BASES, BASES (NON BITUMINOUS) AND SHOULDERS

CLAUSE 401 GRANULAR SUB BASE

Clause 401.1 Scope

Add the following at the end of this Clause:

"A site trial shall be performed using the proposed mix. The trial length of minimum 30m andfor full width of the pavement shall be constructed outside the main works. The main work shallnot start until the trial length has been approved by the Engineer. After approval has been given,the material and mix proportions, construction procedures shall not be changed without the approval of the Engineer. In case, the trial length is made on the main work, it shall be removed".

Clause 401.2 Materials

Clause 401.2.1 First two sentences of the paragraph shall be substituted with the following:

"The material to be used shall be crushed stones only. The material shall be free from organic or other deleterious constituents. The portion of the total aggregate passing 4.75 mm sieve shall have a Sand Equivalent Value of not less than 75 when tested in accordance with the requirement of IS: 2720 (Part – 37)."

Clause 401.2.2 Delete the second sentence from the paragraph and add the following as second paragraph:

The Contractor shall, at least 15 working days before the commencement of the construction ofthe sub-base course, submit to the Engineer, the results for approval of the laboratory testing onthe physical properties defined above. The construction of the sub-base course shall be taken uponly upon the Engineer's approval of the material.

CLAUSE 406 WET MIX MACADAM SUB-BASE / BASE

Clause 406.2.1.1 Physical Requirements

Add the following after first paragraph:

"The constituents of the aggregates shall be produced by integrated crushing and screening plant unless otherwise instructed by the Engineer. The fraction of material passing through 4.75mmsieve shall also be crusher run screening only."

Clause 406.3.3 Preparation of Mix

3rd sentence of the last paragraph shall be read as

"However, at the time of compaction, water in the wet mix should not vary from the optimumvalue by more than $\pm$ 2 percent".

Clause 406.3.4 Spreading of Mix

Add after the last Paragraph:

The work of laying wet mix macadam shall not be done during rain.

The work of laying of wet mix macadam course over an existing bituminous layer shall not bepermitted. The existing bituminous layer shall be removed completely.

SECTION 500 BASE AND SURFACE COURSES (BITUMINOUS)

Clause 501.2 Materials

Clause 501.2.2 Delete "Crushed gravel or other hard material" from second line of Para 1."

CLAUSE502 PRIME COAT OVER GRANULAR BASE

Clause 502.2.1 Substitute the followings:

"The primer shall be cationic bitumen emulsion SS1 grade confirming to IS 8887 and shall berefinery produced. The particular grade to be used for the work shall be got approved by the Engineer."

Clause 502.2.3 Deleted

CLAUSE 503 TACK COAT

Clause 503.2 Materials

This clause shall be read as under:

"Binder: The binder used for tack coat shall be Cationic Rapid Setting (RS-1) bitumen emulsioncomplying with IS 8887 and shall be refinery produced."

CLAUSE 505 DENSE BITUMINOUS MACADAM

Clause 505.2.1 Bitumen: The bitumen shall be paving bitumen of viscosity grade VG 40 conforming toIS:73.

Clause 505.2.2 Coarse Aggregates

Delete the words 'crushed gravel or other hard material' from the first sentence of Clause 505.2.2.Delete para 2 of Clause 505.2.2.

Clause 505.2.4 The first sentence of this clause shall read as "Filler shall consist of rock dust orcement with minimum 2% by weight of aggregates."

The second paragraph shall be read as under:

Where the aggregates fail to meet the requirements of the water sensitivity test in Table 500-8, then anti-stripping agent, approved by the Engineer shall be added without additional cost.

Clause 505.2.5 Aggregate Grading and Binder Content

In Table 500-10, only the following two rows regarding Layer Thickness and Bitumen Grade shall be substituted as below keeping all other Items unchanged.

Grading	1	2
Layer Thickness	>75mm upto 100mm	50-75mm
Bitumen grade (Vis)	VG-40	VG-40

Clause 505.3 Mix Design

Clause 505.3.1 Requirements for the Mix

Add the following requirements to the list of Table 500-11:

- Water sensitivity (ASTM D1075): Retained stability (Ratio of Marshal Stability for 24 h Immersion and 30min Immersion in water at 60degree centigrade temperature) = not less than 75 %.

Clause 505.4.10 (New Clause)

"The Dense bituminous layers except Profile Corrective Course shall be laid with the sensorpaver capable of paving the full width in single operation."

CLAUSE 507 BITUMINOUS CONCRETE

Clause 507.2.1 Bitumen

This clause shall read as

"The bitumen use for the work shall be VG-40 grade, complying with IS:73".

Clause 507.2.5 Aggregate Grading and Binder Content

The Note below Table 500-17 shall be added with:

"The grading of the aggregate mix as used in work shall be a smooth curve within and approximately parallel to the envelope in Table 500-17".

Clause 507.3 Mix Design

Clause 507.3.1 Requirement for the mix

Add the following requirements to the list of Table 500-18:

- Water sensitivity (ASTM D1075): Retained stability (Ratio of Marshal Stability for 24 hImmersion and 30min Immersion in water at 60degree centigrade temperature) = not lessthan 75 %

Clause 507.4.2 (New Clause)

Add the following at the end of para:

"The Bituminous concrete layer shall be laid with the sensor paver capable of paving full widthin single operation".

SECTION 800 TRAFFIC SIGNS, MARKINGS & OTHER ROAD

APPURTENANCESCLAUSE 803 ROAD MARKINGS

Clause 803.2 Materials

This clause shall read as under:

"Road markings shall be hot applied thermoplastic compound with glass beads having at least70% spherical shaped particles and the materials shall meet the requirements as specified in Clause 803.4.

The road markings shall be laid in one layer with appropriate road marking machine approved by the Engineer. Before the road-marking machine is used on the permanent works, the satisfactoryworking of the machine shall be demonstrated on a suitable site, which is not part of the permanent works. The rate of application shall be checked and adjusted as necessary before application on a large scale is commenced, and thereafter daily."

Clause 803.3 Ordinary Road Marking Paint

This Clause shall be deleted.

Clause 803.5 Reflectorized Paint

This Clause shall be deleted.

CLAUSE 806 ROAD DELINATORS

Clause 806.2 This clause shall read as follows:

a) Triangular Object Marker shall be 300mm side with four red reflector, made out of 2mm thick aluminum sheet, face to be fully covered by high intensity grade white retroreflective sheeting of encapsulated lens type as per clause 801. The background/ border/ symbols shall be made by screen-printing of desired colour as per sign details.

b) The sign plate shall be fixed with 6mm dia. aluminium rivets on MS angle iron frame. The angle iron frame shall be made with angle of size 40mmx40mmx5mm. The sign shall be fixed with nut-bolts & welding on MS pipe 50mm dia (NB-MW) and 500mm high.

c) Rectangular hazard marker 600mm x 300mm made out of 2mm thick aluminum sheet, face to be fully covered by high intensity grade white retro reflective sheeting of encapsulated lens type. The background/ border/ symbols shall be made by screen- printing of desired colour as per sign details. The sign plate shall be fixed with 6mm dia aluminium rivets on MS angle iron frame. The angle iron frame shall be made with angle of size 40mmx40mmx5mm. The sign shall be fixed to 80mm dia (NB-MW) MS pipe.

d) Roadway Indicators shall be 1000mm high made with 100 mm dia. NB medium weight MS pipe. One reflector of high intensity grade retro reflective sheeting with encapsulated lens shall be provided on top of the reflector. The white & red reflector shall be provided alternatively of 40mm width, so that total width of reflector shall be 120mm. A wire mesh cover of 150mm height shall be provided on top.

e) All components of signs & supports shall be thoroughly descaled, cleaned, primed and painted with two coats of epoxy paint. The sign backside shall be with grey colour and post shall be white colour / alternate white & black bands. The post below ground shall be painted with three coats of red lead

CLAUSE 807 BOUNDARY STONES

Clause 807.1 General

Add at the end of Para 1, "The boundary stones shall be of concrete as shown in drawing."

Clause 811 CRASH BARRIER

Clause 811.2.2 This clause shall be read as follows:

"Concrete crash barriers shall be constructed with M-40 grade concrete and High Yield Strength Deformed (TMT) Reinforcement conforming to IRC:21."

Clause 811.2.4 Measurements for Payment

This clause shall be read as follows:

"The concrete crash barriers shall be measured in Cubic metres of concrete placed in position excluding steel reinforcement as per drawing and accepted length of barrier in place.

Clause 811.6 Rate:

Add at the end of the clause:

"and paid as per respective BOQ items.

SECTION 900 QUALITY CONTROL FOR ROAD WORKS

CLAUSE 903 QUALITY CONTROL TESTS DURING CONSTRUCTION

Clause 903.4 Tests on Bituminous ConstructionClause

903.4.1 Add at the end of this Clause:

"The density test shall be carried out by 100 mm diameter core cutter machine on Dense Bituminous Macadam and Bituminous Concrete as per the frequency specified".

Add the following note at the end of Table 900-4:

Note:

1. *The laboratory and field tests shall be performed on materials and works at the frequency values indicated against each. The Supervision Personnel shall ensure that there are no deviations in this regard.*
2. *The Contractor shall prepare a detailed manual for Quality Assurance including the methodology for the respective tests, the data formats and the methodology for the analysis and interpretation of test results based on the reference Standards and Practices indicated in the Technical Specifications and obtain the approval of the Engineer.*

SECTION 1000 MATERIALS FOR STRUCTURES

CLAUSE 1006 CEMENT

Add the followings at the end of this clause:

Cement to be used for the work shall conform to the following standard:

a) IS: 8112 – Specification for 43 Grade Ordinary Portland Cement
b) IS:12269 – Specification for 53 Grade Ordinary Portland Cement
c) IS: 455 – Specification for Portland Slag Cement
d) IS: 1489 (Part-1)– Specification for Portland Pozzolana Cement (fly ash based).

For prestressed concrete structures, Ordinary Portland Cement conforming to grade 43 &53 shall only be used.

Mix design for each brand and type of cement shall be submitted for approval of the Engineer before being used in the works.

CLAUSE 1007 COARSE AGGREGATES

Delete from the first sentence "crushed gravel inert material" appearing in 3rd and 4th line of Para 1.

CLAUSE 1008 SAND / FINE AGGREGATES

Delete from the 1st line the word "crushed gravel" and from the 2ndline "gravel" in Para 2.

CLAUSE 1009 STEEL

Clause 1009.3 Reinforcement/ Un-tensioned steel

Add at the end of last para:

The other reference to "HYSD" bars in the Specifications shall be read as TMT bars.

All steel used in the works shall be procured from TISCO, SAIL, RINL. In case steel is obtained from other sources, these steel material shall be from primary steel producers having integrated steel plants adopting BF-BOF or Corex-BOF or DRI-EAF technology to produce liquid steel and crude steel with in-house rolling facility.

CLAUSE 1010 WATER

In Para (c) the permissible limit for Chlorides (Cl) shall be read as "250 mg/lit for structures having length more than or equal to 30 m."

In case of structures of lengths 30m and below, the permissible limits of chlorides may be increased up to 500mg/liter.

SECTION 1100 PILE FOUNDATIONS

Add the following before Clause 1101.1

Piling work shall be cast-in-situ bored piles of diameter as shown on the drawing. Boring / drilling, socketing of piles shall be done by using hydraulically operated rotary drilling machines only. Rock augers with conical shaped teeth made of tungsten carbide or diamond shall be used for cutting through the upper strata. For cutting through hard strata core cutters shall be used. The rotary, drilling equipment shall not be more than 5 years old.

Clause 1101.2 Add the following at the end of clause 1101.2**:**

The contractor shall submit information regarding proprietary system of piling as per Clause 115.4.

The Contractor in his method statement shall include the procedure for carrying out routine vertical and lateral load tests of piles including design calculations and drawings. The format for reporting test results shall be included in the method statement.

Clause 1101.4 Add the following as sub-clause 1101.4

The scope of work shall comprise the following:

a) Providing all materials including concrete, reinforcing steel, Bentonite slurry for stabilizing the bore, temporary casing as required, labour and equipment for installation of bored cast-in-situ piles in any situation including marshy soils, water logged land and back waters of sea.

b) Initial and routine testing of piles.

c) Provision of access to movement of Equipment, barricading where necessary, pollution control measures including measures to control noise to minimum acceptable levels and site clearance.

Clause 1103 TYPE OF PILES

Add at the Beginning:

Bored cast-in-situ piles as shown in drawings or as directed by the Engineer shall be provided.

Clause 1118 MEASUREMENTS FOR PAYMENT

Replace the 3rd para with the following:

"Routine Load Test shall not be measured for payment, whereas Initial Load Test shall be measured separately in number and is payable."

Clause 1119 RATE

Delete the 1st & 2nd para and add the followings:

"The contract unit rate for cast-in-situ bored piles shall include the cost of concrete and all other items as per Section 1700 of these Specifications. The contract unit rate shall also include costs of all labour, materials, equipments and all other incidentals involved in conducting routine load test."

SECTION 1500 FORMWORK

CLAUSE 1501 Description

The Clause shall read as below.

The Contractor shall prepare a formwork mobilization and utilization plan and submit the plan for Engineer's approval at least 28 days before the commencement of construction of structures. The requirement of formwork shall be worked out considering the overall construction program of all the structures to be cast in one or more stages, as specified in the drawings. The plan shall take into account the time required for erection of formwork, retention in position, stripping, and removal and subsequent use in the next and subsequent structures.

Notwithstanding Engineer's approval of mobilization plan, if due to any reason, Contractor has to arrange additional formwork, to meet the requirements of the construction program, it shall be done by the Contractor without any extra cost to the Employer/Engineer.

Clause 1503 DESIGN OF FORMWORK

Clause 1503.2 The following shall be added at the end of this Clause:

"For distribution of load and load transfer to the ground through staging, an appropriately designed base plate or grillage must be provided which shall rest on firm sub-strata".

CLAUSE 1504 WORKMANSHIP

Clause 1504.1 Add the following at the end of Clause 1504.1

The loading from the formwork shall be distributed to the soil or the permanent works below (e.g. pile cap) in such a manner that any total or differential settlement are within acceptable limits. Subsoil characteristics shall be taken into account while designing the staging to avoid untoward failures. All the pipes etc. used for staging shall be free from kinks, bends etc.

CLAUSE 1506 PRECAUTIONS

Add the following as items of this clause:

- Adequate support against sideway and lateral loads due to construction operations and wind shall be provided.

- In case cantilevers are supported directly from the ground, the supports for cantilevers shall remove simultaneously with main supports only after approval for the same fromthe Engineer.
- Forms shall be rigid and of adequate section to reduce deflections. Forms shall have sufficient rigidity to resist horizontal pressures caused by flowing concrete resulting from use of super plasticizers. The formwork shall resist the lateral pressure caused due to fast rate of placement by concrete pumps.

Clause 1508 REMOVAL OF FORMWORK

Add the following at the end of the paragraphs.

For prestressed units, the side forms shall be released, as early as possible and the soffit forms shall permit without restraint, deformation of the member, when prestressing force is applied. Form supports and forms for cast in situ members shall not be removed until sufficient prestress has been applied to carry the dead load and any formwork supported by the member and anticipated construction loads.

SECTION 1600 STEEL

REINFORCEMENTCLAUSE 1602

GENERAL

Paragraph 2 of Clause 1602 shall read as follows:

"Reinforcements shall be High Yield Strength Deformed (TMT) bars of grade Fe 500 conforming to IS: 1786 – 2008. Only uncoated steel shall be used as reinforcement unless specified".

All steel used in the works shall be procured from TISCO, SAIL, RINL. In case steel is obtained from other sources, it shall be with specific written instruction from the Engineer who in turn shall ensure that these are from primary steel producers having integrated steel plants adoptingBF-BOF or Corex - BOF or DRI - EAF technology to produce liquid steel and crude steel with in-house rolling facility.

CLAUSE 1604 BENDING OF REINFORCEMENT

Para 1 & 2 of Clause 1604 shall be read as follows:

The reinforcement shown on the drawings shall be considered merely symbolic representations of the shape and position and shall not be used by the Contractors to justify any deviation from the stipulated requirements. Bar bending schedules and any supplementary drawings as may be required shall be furnished by the Contractor and got approved by the Engineer before start of work. The bending schedules shall state the number, shape and length of bar and weight in respect of each type. System of bar referencing should

be coherent and systematic. A separate bar bending schedule shall be prepared for auxiliary bars like spacers, chairs etc.

CLAUSE 1605 PLACING OF REINFORCEMENT

Paragraph (c) (i) of Clause 1605 shall be read as follows:

Cover blocks shall be made of concrete or cement mortar with the same durability properties as the surrounding concrete and with the same type of constituents. In visible surfaces, the cover blocks shall be of the same colour and texture as the surrounding concrete. The Contractor's proposal for cover blocks shall be submitted to the Engineer for acceptance.

CLAUSE 1606 BAR SPLICES

Clause 1606.1 Add the following as paragraph 2 of Clause 1606.1:

The location of joints in continuous reinforcing bars, not shown in drawings, shall be submitted to the Engineer for acceptance. If nothing contrary has been specified, the number of bars to be joined in any cross-section shall not exceed one-third of the total.

Clause 1606.2 Welding

Clause 1606.2.1 Add the following at the end of the paragraph.

In prestressed concrete members, when welding of un tensioned reinforcement is permitted bythe Engineer, it shall be carried out before insertion of the prestressing tendons/sheathing.

SECTION 1700 STRUCTURAL CONCRETE

CLAUSE 1707 EQUIPMENT

Para 1 of this Clause shall read as under:

"Unless specified otherwise, equipment for production, transportation and compaction of concrete shall be as under:

a) For production of concrete: Batching and mixing of the concrete shall be done in a concrete batching and mixing plant fully automatic. The plant shall be approved by the Engineer."

Paragraph 3 of this clause shall read as follows:
"The accuracy of measuring devices shall fall within the following limits:

Measurement of Cement in each batch.	±1% of the quantity of cement
Measurement of Water waterin each batch.	±1% of the quantity of
Measurement of Aggregate Aggregate in each batch.	±2% of the quantity of
Measurement of Admixture Admixture in each batch.	±1% of the quantity of

Serial no. b) & c) shall remain unchanged.

Add the following paragraph at the end of the clause:

Batching, mixing transportation and placing concrete.

Once the concreting of a section is started, it has to be completed as a continuous operation. Before starting an important placement, the Contractor shall submit to the Engineer an equipment list to ensure that sufficient equipment is available for batching, mixing, transporting and placing concrete and once the concreting of a section is started, it can be completed as a continuous operation within a reasonable time.

CLAUSE 1716 TOLERANCES

Add the following at the end of Clause:

"In the absence of any information in drawings or specifications, for particular cases, the following limitations shall apply.

Deviations from Position etc.

a)	Deviation from specified position in plan	± 10 mm
b)	Variation in levels at top	± 10 mm
c)	Variation of reduced levels of bearing areas	± 5 mm
d)	Variation in plumb over full height of piers	± 10 mm
e)	Surface irregularities measured with 3 m straight edge	
i)	all surfaces except bearing areas	± 5 mm
ii)	bearing areas ± 3 mm	
f)	Variation in length of superstructure - overall and length between bearings	± 10 mm Or +0.1% of thespan length, whichever is lesser

SECTION 1900 STRUCTURAL STEEL

Clause 1903.4 Paints

Delete para-2 and add the following as per IRS B1-2001 Clause No. 39.1and 39.2.1 as below.

1. No part of the work shall be painted or coated, packed or dispatched, until it has been finally inspected and approved by the Engineer. Dry Film Thickness shall be measured by elcometer or any other method approved by the Engineer.
2. When so specified by the Engineer, the whole of the work except machined surfacesshall be given protective coating using one of the systems of painting or metallizing given below in para 2.1. Prior to the application of protective coating, the surface of work shall be carefully prepared removing mill-scale, rust, etc. using wire brushes, sand or grit blasting as stipulated and approved by the Engineer.

2.1 For locations where the girders are subjected to salt spray such as in close vicinity of the

sea and/or over creeks etc. the protective coating by metallizing with sprayed aluminium followed by painting as per painting schedule given below may be applied:

(i) One coat of etch primer to IS:5666.

(ii) One coat of zinc chrome primer to IS:104 with the additional proviso that zinc chrome to be used in the manufacture of primer shall conform to type 2 of IS:51.

iii) Two coats of aluminium paint to IS:2339 brushing or spraying as required. One coat shall be applied before the fabricated steel work leaves the shop. After the steel work is erected at site, the second finishing coat shall be applied after touching up the primer and the finishing coat if damaged in transit.

Unless otherwise specified, paints shall conform to the relevant IS specifications. The paints which have been tested for the following qualities as per specifications given in the relevant IS codes only shall be used:

- Weight test (weight for 10 liter of paint, thoroughly mixed)
- Drying time
- Consistency
- Dry thickness and rate of consumption.

SECTION 2100 OPEN FOUNDATIONS

Clause 2104.1 Preparation of Foundations

Substitute M15 with M10 in the first paragraph

CLAUSE 2106 TOLERANCES

Reference to Tolerance shall be made to Clause 1716.

SECTION 2200 SUB - STRUCTURE CLAUSE

2204 PIERS AND ABUTMENTS

Add the following paragraph at the end of clause:

"Wherever necessary, suitable cofferdams or other means shall be provided to exclude water from the construction area. The Contractor shall provide necessary pumping equipment for dewatering areas".

Clause 2210 Rate

This Clause shall read as follows:

"The contract rate for masonry, concrete and reinforcement in substructure shall include all works as given in respective sections and cover the cost of incidental items like providing cofferdams, dewatering, providing special formwork, where necessary, and all other items forfurnishing and providing substructure as mentioned in this section."

The necessary material (thermocole, bituminous fibrous board or equivalent material) and labour, tools etc. required for maintaining 20 / 40 mm gap between faces of various structures (old / new) wherever required / as shown in drawing shall be incidental to work and shall not be measured / paid separately.

SECTION 2700 WEARING COAT AND APPURTENANCES

Clause 2702.1 Replace the Sub-para with the following:

Bituminous wearing coat shall comprise of 40 mm bituminous concrete overlaid with 25 mm thick bituminous mastic asphalt.

SECTION 2900 PIPE CULVERTS

Clause 2911 Payment of concrete works in pipe culvert including head wall, parapet wall and cradle to be constructed as per drawing, Technical specifications and as directed by Engineer will be paid separately as per provision of respective item in the Bills of Quantity (BOQ).

SECTION 3000 MAINTENANCE OF ROAD

Clause 3001: Add the followings at the end

1. The contractor will be responsible for maintenance of the road (existing as well as all permanent works) from the day the worksite is handed over till the possession of completed work is taken over.

2. The contractor will have to keep the road traffic worthy and in reasonably goodcondition throughout the construction period so as not to cause any inconvenience to the traffic.

3. During the construction period, contractor will have to attend to the following maintenance works from time to time to the satisfaction of the Engineer.

3.1. Restoration of rain cuts and dressing of side shoulders;

3.2. Maintaining public vehicular access along the ROW and from ROW to all public and Private accesses at all times and in good condition by carrying out repairs and maintenance as directed by the Engineer;

3.3. Maintenance of roadside and cross drains to ensure that drainage is not affected;

3.4. Filling potholes and patch repairs in bituminous surface with a bituminous pre-mix after trimming the pot hole / depression to proper shape and depth with necessary tack coat and proper compaction with road roller.

During construction period it would be necessary to divert the traffic from new carriageway to existing carriageway and vice-a-versa to facilitate undertaking of permanent works on existing carriageway. Construction of such diversions by cutting across central median and maintaining the same will be the contractor's responsibility and shall be at his cost.

SECTION 3100 REINFORCED SOIL

Clause 3102 Design

Add the followings at the end of para:

IRC: SP: 102-2014 (Guidelines for Design and construction of Reinforced soil walls)/BS:8006-1:2010 (Code of Practice for strengthened/reinforced soils and other fills) shall be followed.

The contractor shall need to assess and substantiate the availability and design adequacy

of soilsafe bearing capacity under the location of the wall before execution of the work.

Clause 3103 Reinforcing Element

Replace the Clause with the followings:

Reinforcing materials such as Geo-synthetics in the form of high tenacity polyester geostrips or geogrids with polyethylene coating shall be used as reinforcing element. The proposed polymeric reinforcement shall have proven experience of minimum 10 years internationally or in India and polymeric reinforcements having proven experience less than 10 years shall not be used. The selection of suitable reinforcing element shall be as per specifications given in the document and shall be approved by the Engineer.

Geo-synthetics

The material factors as per the guidelines given in ISO TR20432, for specified design life of reinforced soil wall structure and design temperature for the project, shall be used to determine the long term strength of the geosynthetic reinforcement for design of reinforced soil wall structure. The design temperature shall be evaluated based on definition given in FHWA-NHI-00- 043 and design life shall be 100 years. The agency should provide independently certified partial material factors to be considered in the design of RS Wall for the geosynthetic reinforcement for design temperature and design life of reinforced soil wall structure. The agency should also provide independently certified creep test data for the product with tests extending for minimum period of 10 years and independently certified creep properties and reduction factors for creep should also be made available at design temperature and design life of reinforced soil wall structure as per guidelines given in ISO TR20432. The agency should provide test reports of durability tests as per ISO TR 20432 and default value of 1.1 as per FHWA shall not bepermitted.

All quantity control strength of geosynthetics must represent minimum average roll values (MARV) corresponding to 95% confidence limit. Testing of geosynthetic for tensile strength shall be performed in accordance with ISO 10319 for every 20,000m of geostrips and test data for eachlot of material shall accompany shipments.

The geostrips shall be made from high molecular weight and high tenacity polyester (PET) yarns. The reinforcing elements to be used for the project shall be manufactured at ISO 9001:2008 certified production facility only. The polyester used for manufacturing geostrips should satisfy the following requirements:

- Minimum molecular weight no. > 25000
- Maximum carboxyl end group no. (CEG) < 30

Polyester geo-strips shall be provided with a protective polyethylene coating to maximize the resistance to hydrolysis and enhance durability and increase survivability during construction and in service.

Connection

Connection between the facia and the reinforcing element shall be using galvanised steel loops (minimum 10mm diameter) & toggles bars (minimum 25mm diameter) designed as per relevant Indian Standards. If polymeric connections are used or any components of connections are made of polymeric material, the agency shall provide the results of tests

carried out on the connection to establish the connection strength between the facia and reinforcing elements from independent accredited body or government agency /Institute as per the requirement of BS 8006. In the absenceof test report the connection shall be approved and must be tested.

QUALITY CONTROL AND TESTING OF MATERIALS

Testing shall be done as stated elsewhere in this specification on all materials required for reinforced soil structure construction. The tests shall be done from a reputed independent agency or at the manufacturer's facility under the presence of Engineer or his representative as and when required. All tests and testing certificates shall be submitted to the Engineer at least 7 working days prior to use of any material. Tests on materials before and during construction shall not be limited to the following types.

For Geosynthetic reinforcing elements

i. Tensile strength certificate from the supplier for each lot.

ii. Testing at manufacturer's facility witnessed by Engineer's representative to verify the test results.

iii. Determination of interaction coefficients by shear box test, maximum once in a project, if the values used in design are not as per the codes of practices, otherwise at owner's costs.

iv. The following particulars of the proposed geosynthetic reinforcing elements and connections shall be submitted to the Engineer:

a. Literature on the proposed reinforcing element and connection.

b. Copies of valid quality assurance certificate such as ISO 9001 or equivalent certifying the quality system for the manufacturing of the reinforcing elements.

c. A certificate showing the manufacturer's name, the date and place of manufacture and showing that the reinforcing element complies with the requirements stated in the contract and including the results of tests specified in the contract or as specified by the Engineer.

v. Samples of the reinforcing elements and connections shall be submitted to the Engineer at the same time as particulars of the material are submitted.

Joint Fillers:

i. Bedding material between the horizontal joints (excluding the joint between the PCC base and The bottom most panel) of the panels shall consist EPDM (Ethylene Propylene Diene Monomer) material/pad. Whereas the bedding material between the PCC base and the bottom most panel shall consist of either cement mortar or durable gasket seating such as resin bonded cork, bitumen bonded cork or EPDM.

ii. Sealing material for filling joint gaps, if required, other than bedding joints shall consist ofclose

iii. cell polyurethane foam strip or non-woven polypropylene/polyester Geotextile of unit weight not less than 125 g/m^2.

iv. The joints (vertical and horizontal) between the panels shall be covered from inside with non woven polypropylene/polyester geotextile strips glued to the facing element ensuring full coverage of joints. Synthetic glue shall be used for this purpose. The width of the geotextile strip shall not be less than 100mm."

Clause 3105 Facia Material

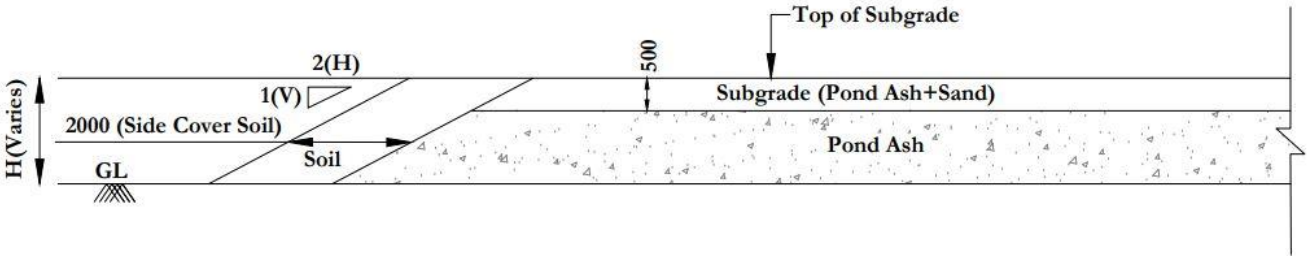
Substitute the Clause from 3105.1 to 3105.3 with the followings:

The facia panel shall be precast reinforced concrete **cruciform-shape panels** with nominal thickness of 180 mm, including facing textures, logos and embellishments. The grade of concrete shall be minimum M35. The concrete shall confirm to the requirements of Section 1700 of these Specifications.

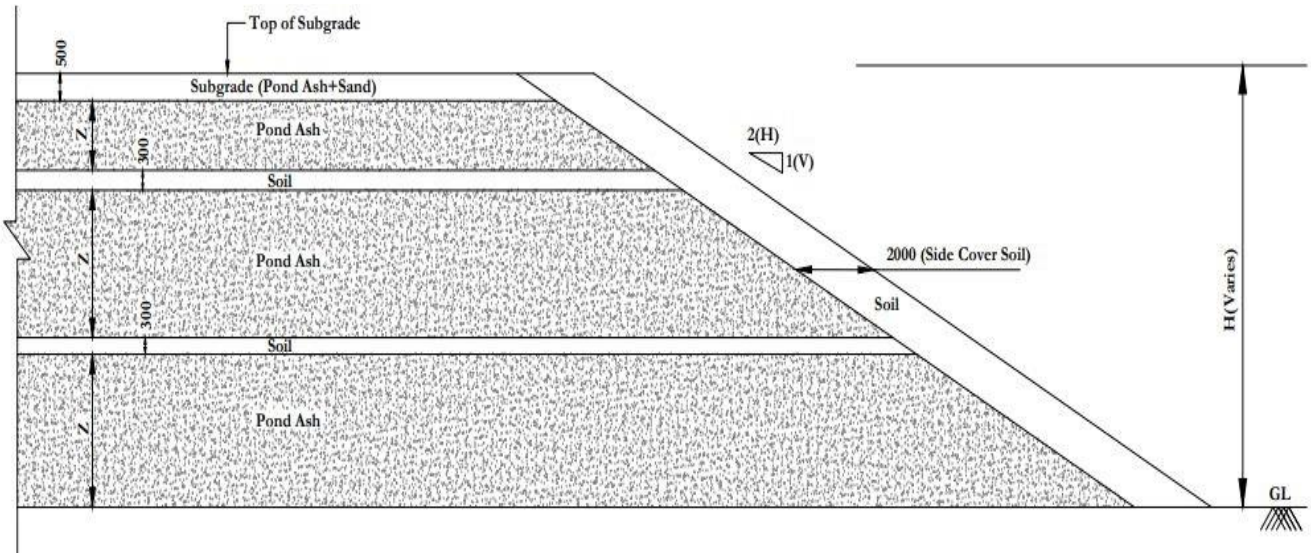
The facia panels shall have provision of both horizontal and vertical gaps to prevent concrete to concretecontact.

ADDITIONAL TECHNICAL SPECIFICATIONS

CLAUSE A- 1 ADDITIONAL SPECIFICATION FOR FLY ASH AND SAND MIX FORSUBGRADE FILL MATERIAL



SCHEMETIC DIAGRAM FOR CONSTRUCTION OF EMBANKMENT WITH ALTERNATE LAYERS OF POND ASH AND SOIL (FOR HEIGHT < 3m)



SCHEMETIC DIAGRAM FOR CONSTRUCTION OF EMBANKMENT WITH ALTERNATE LAYERS OF POND ASH AND SOIL (FOR HEIGHT<3M)

1 General

Pond ash/fly ash can be used as fill material for embankment and in mix with coarse sand as subgrade fill. The sides of the fill shall be covered with borrowed soil having PI values more than 12 but less than 20 to prevent erosion of the fill material. It shall be ensured that the fill material is not deposited in saturated condition. Compaction shall be carried out to minimum 97% of the maximum dry density at optimum moisture content.

2 Material

The properties of the pond ash/fly ash to be used as fill material shall generally have the following characteristics:

In case of any deviation in values if any characteristics of the fly-ash, excepting MDD and Plasticity, Contractor shall bring it to the Notice of the Engineer, prior to using such fly-ash material, which can be used only on specific prior approval of the Engineer

CLAUSE A-2 ADDITIONAL SPECIFICATIONS FOR MAINTENANCE OF RIGHT OF WAY

Throughout the period of the Contract the Contractor shall at all times maintain public vehicular access along the right-of-way and from the right-of-way to all public and private access and land, as exists immediately prior to his commencement of the Works.

The Contractor may on written request to the Engineer, (including a drawing, program and specification), be given approval to operate:

(a) a road diversion suitable for the road traffic and suitable width, or

(b) traffic on a one way system using manual coordinated direction control or automatictraffic lights having a secure source of power.

Sl. No.	Parameters	Range
1	Specific Gravity	1.90 – 2.55
2	Plasticity	NP
3	MDD (gm/cc)	1.15 - 1.25
4	OMC (%)	18.0 – 26.0
5	Cohesion (kg/cm^2)	0.0 -0.05
6	Angle of Internal Friction (φ)	30.0^0 – 35.0^0
7	Coefficient of consolidation, C_v, (cm^2/sec)	$1.75x10^{-3}$ – $1.90x10^{-3}$
8	Compression index, C_c	0.05 – 0.1
9	Permeability (cm/sec)	$7x10^{-5}$ – $5x10^{-3}$
10	Particle Size Distribution Clay size fraction Silt size fraction Sand size fraction Gravel size fraction	 0.0 – 5.0 8.0 – 65.0 10.0 – 90.0 0.0 – 5.0
10	Coefficient of uniformity	3.1 – 10.5

Applications for approval shall show every detail of the proposals including road

construction (cross section including pavement and surfacing, and profile and drainage), road signing, communication between the ends of the controlled section lighting and proposed period of operation.

One way systems shall be provided with adequate sign posting and the Contractor shall limit delays to any traffic to the minimum and with the approval of the Engineer. The travelling public shall be notified by signs, of exceptional delay well in advance of the site of delay, as required by the Engineer.

Payment for temporary diversions, traffic provisions and maintenance of roadways shall be asprovided in the Contract and as instructed by the Engineer**.**

CLAUSE A-3 GEOTECHNICAL INVESTIGATIONS (DETAILED EXPLORATION)

1. SCOPE OF PROPOSED INVESTIGATIONS

The exploratory Geotechnical Investigations are required to be conducted at location. All geotechnical investigation shall be done through Agency approved by the Engineer.

This work shall be considered incidental to the foundation works and nothing extra shall be paid.

The scope of the geotechnical investigation is discussed below and is given in the Bill of Quantities.

The present scope of work includes drilling of exploratory boreholes, collection of disturbed and undisturbed samples, conducting Standard Penetration Tests and Vane Shear Tests and all other required laboratory tests.

2. SPECIFICATIONS

FIELD WORK

a) Boreholes

The borehole diameter shall be of adequate size (at least 150 mm) to obtain 100mm diameter undisturbed samples from the borehole. The borehole depths are likely to vary depending on location. The probable maximum depth is likely to be about 55 to 60m.Field testing in boreholes includes Vane Shear Tests and Standard Penetration Test as stipulated by the engineer during execution. Sampling in boreholes includes undisturbed and disturbed sampling of all types of materials, rock cores and groundwater. All field and laboratory testing shall be conducted in accordance with relevant IS Codes and as stipulated by the Engineer.

b) Drilling in Soils Other Than Rock

The boreholes should be drilled at the locations indicated on the drawing to be furnished by the Engineer.

Rotary drilling rig preferably hydraulically operated, with drill pipes and drill bits, swivel type double tube core barrels of M-series with matching diamond bits/triple tube core barrels or type as required by the Engineer, undistributed soil samplers like push sampler/piston samplers, SPT equipment, drilling mud chemicals, all consumables and all other accessories and spares as required for investigations in all kinds of soils and rocks shall be mobilized by the contractor. The rotary drill method shall be preferred to shell and augur method while boring in soil. Calyx type drilling rigs shall not be allowed under any circumstances. The method of advancing the borehole in soil overburden by establishing the sides of the boreholes by drilling mud (Bentonite) is considered preferable to casing of the borehole. Drilling should be carried out in such a manner as to limit disturbance of the soil to be

sampled or tested to a minimum. Washing tools should have proper side jets and under no circumstances will bottom discharging tools be permitted. The insert casing shall be sufficientto allow for in-situ sampling and testing with standard sampling and testing tools.

Electronic theodolite and other necessary survey equipment shall be mobilized along with necessary personnel for operation of the same for positioning of the borehole locations and measuring ground levels.

All personnel required for round-the-clock operations including a graduate engineer in each shift should be available at site. All such personnel mobilized for each shift of 12 hours shall have minimum of three years of experience in the same type of job. The project in-charge shall be a post-graduate geotechnical engineer with minimum of five years of experience in the same type of job.

The borings shall be carried out in accordance with relevant Indian Standard Code of Practice and the requirements stated herein. The boring, sampling and in-situ testing shall be carried out in a manner approved by the Engineer who shall have the right to order alternative procedures if he is not satisfied with the quality or accuracy of the work.
The observations during boring shall be put down in such a manner, so that each change in strata is accurately determined to the satisfaction of the Engineer. During the boring operation, particular attention shall be paid to the disturbed material washed up or brought up by the shell and auger, and these shall be described in the boring logs. These disturbed materials should be preserved in polythene bags with tags stating borehole reference, depths, nature of soil etc.

The work of drilling in soil shall be carried out in such a manner that disturbed as well as undisturbed samples of soil can be conveniently collected at the required depths/intervals, and penetrometer tests can be carried out if required. The Contractor shall adopt such a method, which will permit the collection of samples indicating the grain size distribution of natural strata without loss of fines, covering the entire depths.

Water samples shall be collected from the boreholes. Water samples shall be collected prior to addition of Bentonite to boreholes. If this is not possible then prior to collection of water samples, the borehole shall be dewatered by about half a meter depth and water allowed rising back prior to sampling. Ground water level for each borehole shall be checked during boring operation and shall be recorded in bore log.

The drilling operations may be interrupted for collecting the samples, probing and conducting penetrometer tests etc. The casing pipes shall not be removed unless directed by the Engineer. Even after removal of the casing, a piece of pipe should be left in the borehole to identify the location.

The Contractor shall ensure that sand-blow conditions do not develop while drilling, sufficient surcharge of water or drilling mud should be maintained all throughout the drilling operation.

In the exploration programme the contractor shall associate with the provisions of IS:1892.

c) Undisturbed Soil Samples

In overburden undisturbed samples shall be recovered from the borings at intervals not exceeding 3m and at every change of strata. The undisturbed sampling shall conform to IS Code 2132 (1972). Undisturbed samples shall be collected in returnable tubes of 100mm internal diameter. Attempts should be made to collect undistributed soil sample of 500mm to 600mm in length.

The sample tube shall have a proper identification mark painted on it (e.g. borehole reference, depth, location, arrow mark indicating bottom end of the sample tube etc.). The moisture in undisturbed samples shall be carefully preserved by sealing both ends of the sample tube by applying a double coat of cotton waste and paraffin wax.

d) Disturbed Soil Samples

Disturbed soil samples shall be collected from boreholes. These shall include soil samples collected from the split spoon samples and also from the cutting edges of UDS.
The samples shall be stored in plastic bags.

e) Drilling in Rock

In general, boreholes should be taken to relatively hard strata. Should rock be encountered in soil borings, it shall be proven by core drilling for a penetration of at least 3 m, or as directed by the Engineer. Rock cores shall be retrieved in minimum NX size by using swivel type double or triple tube core barrels with a suitable core catcher and diamond bit. Single tube core barrels or calyx type drills will not be permitted. Drilling mud or any other fluid likely toaggravate core slips shall not be used.

If required, in all types of rock, the borings will be extended more than the depths specified above, as directed by the Engineer. When drilling in all types of rock, instructions given in IS 4078, 4464, 5313 and 6926 shall be followed.

During the drilling operation, particular attention should be paid to get the core recoveries and rock quality designations of the highest standards. Percentage core recovery and RQD should be indicated continuously from the depth starting from the level of highly weathered rock. If the core is broken by handling or during drilling, the fresh broken pieces shall be placed together and counted as one piece. This has to be done as the cores come out during drilling, with the permission of Engineer.

Soil samples and rock cores collected continuously to full depth of boreholes should be clearly marked with good quality oil paint. They shall be designated by number, arrows, depths, borehole to which it belonged etc. for the purpose of identification at a later date. Sketch pens or marker pens shall not be used for writing numbers on core pieces.

When bedrock is encountered, drill hole shall continue at least three meters in sound rock to ensure the continuity of the strata. If weathered or soft rock is met with, drill hole shall continue 5 meters into the rock layer. However, if heavily shattered rock due to various weathering process or weak rock zone susceptible to erosion when subjected to action of flowing water or any other types of rock which cannot be recommended as a founding strata is met with continuing 6 to 7 meters then the drilling shall continue through the weak zone

well into the sound rock below the top weak zone. Such incidences shall be brought to the attention of the Engineer and no borehole shall be terminated without the approval of the Engineer.

The characteristics/strength of rock with respect to weathering, hardness, joints and bedding and rock quality designation (RQD) as presented in Tables 2,3,4 and 5 in Appendix I of IRC 78-1983 shall be followed and the same shall be indicated in the bore logs.

Drilling through rock being a specialized work, every care shall be taken to notice and record any small change during drilling. The time required to drill through a certain depth, amount of core recovery, physical condition, length of pieces of core, joints, colour of water residue, weathering, and evidence of disturbance and other effects shall be carefully noticed and entered in the drill/core log. The directions given in IS 5319 – "Guide for Core Drilling Observation" may be followed while preparing the core logs.

The core boxes provided by the Contractor shall be sturdy and of good quality G.I.M.S. 18 Gauge and shall be made according to the sketch on Page 6 of IS 4078 (1980) with locking arrangements and compartments. The core boxes shall be painted inside with oil paints. Each and every core piece extracted from the core barrel shall be placed in core boxes in the proper sequence of occurrence from top downwards. The starting and finishing depth of each run shall be recorded on the core box compartments in oil paint as the cores are placed. They shall be sequentially numbered on the four sides and the lid. The name of the project, drill hole reference, and the depth of the core obtained shall be prominently painted on the lid with oil paint.

The depth of cores below ground level shall be indicated at about every 1.5m interval by writing the depth in indelible ink on wooden spacers that shall be inserted in their correct positions in the box. Similarly, the exact depth of any change in stratum and failure to recoverthe core etc. shall be recorded. The labelling of core samples of rock shall be done in accordance with the Appendix D of IS 4078 of 1980 or as directed by the Engineer.

Each core box shall house samples not more than 6 m long in total. While placing the core samples in the wooden boxes, it should be ensured that the direction and sequence of core placement is not altered. The core run shall be restricted to 500 mm to 600mm length at a time and the core sample removed as directed by the Engineer. The cores and core boxes shall be transported to a storing place as indicated by the Engineer.

The Contractor shall submit five copies of cabinet size (160mmx120mm) colour photographs of the selected cores as specified by the Engineer.

An arrangement should be made for collection of wash water by installing a top socket with a cross pipe at the top of the casing before the start of rock drilling. The side of the casing should be well packed near the top of the hole to prevent leakage. Wash water should be collected in buckets and allowed to settle. A record of wash water shall be maintained indicating colour, change in colour and type of wash water (i.e. thick slurry or clean water.

The number of revolutions per minute for the rock drilling shall be kept low (about 200 RPM) for "NX" size bits, with suitable reduction gear and bit pressure kept to a minimum without rod vibration on "chatter". The rate of penetration for every 250 mm shall be

observed during rock drilling and recorded.

Field bore logs shall be submitted to the engineer after completion of each borehole at site or as demanded by the engineer.

IN-SITU TESTING

The item covers conducting in-situ test and may include;

- Standard Penetration Tests
- Field Vane Shear Tests

a) Standard Penetration Test in Boreholes

The Standard Penetration Test [SPT] shall be carried out in boreholes at intervals as directed by the Engineer. Intervals shall not exceed 3 m according to Indian Standard Code of Practice.
For details of the sampling tube (spoon) and equipment and procedure for conducting a penetrometer test, the IS Code 2131 (1963) shall apply. The driving monkey should be provided with suitable arrangement for controlling the height of fall. It should be ensured that blowing in of fine sand is avoided while conducting penetrometer tests. For this purpose, it may be necessary to use mud (Bentonite) circulation or create surcharge pressure.

For SPT the blow count shall be recorded at intervals of 150mm, for a total penetration of 60mm. The SPT blow count shall be reckoned as the total number of blows for the second and third penetration increments of 150mm.

Every attempt shall be made to recover the full sample from the standard split spoon sampler. Where sample recovery is poor or nil, a representative sample shall be preserved from the sludge pump/bailer sample.

Whenever a sample recovery is recorded, the following details shall be noted along with usual record of blow counts. This information shall be recorded for each borehole, in a format approved by the Engineer.

- Penetration and blow counts (meters)
- Recovery (meters)
- Logging of silt and fine sand, if any, observed.
- Description of soil sample.

In the case of stiff to medium clay where a sample is recovered in the form of a "cake" a suitable length of cake shall be wrapped with a layer of bandage cloth and coated with paraffin wax to preserve the sample.

The identification tag for the sample shall be carefully secured to the plastic container in which samples are preserved.

b) Field Vane Shear Test

Field Vane Shear Test shall be conducted as stipulated in the relevant IS codes. During boring operation, when soft clay layers are encountered the same shall be brought to the notice of theEngineer who shall decide whether Vane Shear Tests are to be conducted in such strata.

LABORATORY TESTING

All the specified laboratory tests shall be conducted in a nationally accredited laboratory in consultation with the Engineer. Such laboratory should have recognition from the National Highways Authority of India, Government of India. The relevant Indian Standard Codes of Practices for Soil Testing shall be followed.

For preparing the laboratory test schedule, a list of all soil and rock core samples collected from each borehole shall be submitted to the Engineer with records of bore logs and in-situ tests in duplicate. One of the copies shall be returned to the Contractor indicating the tests to be conducted. All the consolidation and permeability tests on collected samples shall be conducted at the laboratory of reputed institutes like IIT or as approved by the engineer.

The results including plots and tables shall be submitted along with the report. Test observations and calculations shall be made available to the engineer if demanded.

Preparation of Test Specimens

Preparation of test specimens for the various tests shall be carried out as per the procedures laid down in the various relevant Codes of Practice.

In case of soft to firm cohesive undisturbed soil samples, test samples for all types of shear tests shall be prepared strictly by hand trimming or soil lathe. Care shall be taken against bending of soil samples at the time of horizontal ejection of the samples from the sampling tubes. Samples shall be ejected from the sampling tubes preferably in the same direction of travel in which the samples entered the sampling tubes.

Similarly test specimens for consolidation tests shall also be prepared to the required size by hand trimming only and the ring of the consolidation apparatus shall be inserted by pressing gently with the hands and carefully removing the material around the ring. In no case the ring shall be forced into the soil. Great care shall be taken during the trimming of the sample from the top and the bottom of the ring. The test specimen shall be prepared in the same orientation as that of the actual strata so that the laboratory test load compresses the soil in thesame direction relative to the soil strata as the applied load in the field.

Index Property Tests

Laboratory tests shall be carried out in consultation with the Engineer and as per relevant parts of IS:2720 to find out the following index properties:

Natural Moisture Content Sieve and

Hydrometer analyses Atterberg Limits

Specific gravity

Bulk and Dry Density

The soil samples to be tested shall be selected by the Engineer

Unconfined Compression Test

Rock samples having L/D ratio not less than 2 shall be prepared and tested under soaked

condition for uniaxial crushing strength as per IS:9143 and IS:9221. The stress-strain relationship and modulus of elasticity shall also be reported. Bulk and dry densities, porosity, water absorption, specific gravity shall also be determined on rock samples as per IS:1124.

Triaxial Test

Unconsolidated, undrained triaxial test shall be conducted on the undisturbed samples selected by the Engineer. The test shall be conducted as per IS:2720 (Part X). Each test shall be conducted on a minimum of three specimens at different cell pressure (1.0, 2.0 and 3.0 kg/cm2).
The moisture content before and after the test and the bulk and dry densities of each specimenshall be determined. The rate inserted by the tenderer in the bill of quantities for the triaxial compression test shall include for all the above items.

The stress-strain diagrams as well as the Mohr circle envelopes shall be included in the report.

- **Consolidation Test**

Consolidation test shall be conducted on undisturbed samples as per IS:2720 (Part XV) selected by the Engineer. The loading on the test specimens shall be applied in the following stages: 0, 0.1, 0.25, 0.5, 1.0, 2.0, 4.0, 8.0 kg/sq.cm. Unloading of the test specimens shall be done in suitable stages. The co-efficient of consolidation (Cv), the coefficient of volume compressibility (Mv), compression index (Cc) and the coefficient of permeability (k) shall be determined and reported.

- **Chemical Analysis**

Chemical analysis of soil and water samples shall be carried out for pH value, sulphate content (SO3) and chloride content (CI) in ppm and percentage.

2. CODES AND STANDARDS

All field and laboratory work shall be carried out strictly in accordance with IS Codes of Practice and these specifications, unless otherwise approved by the Engineer in writing. In case of conflict, the IS Codes of Practice shall prevail unless otherwise instructed in writing by the Engineer.

3. REPORTING REQUIREMENTS

The work includes the preparation and submission of an Investigation Report containing plans showing the location of boreholes including coordinates and levels, plans showing boreholes, project details and description of work carried out, bore logs, core logs, field test results and laboratory test results. Report should also contain interpretation of test results, recommendations for founding levels and bearing capacities, potential settlements and groundimprovement.
The recommendations shall especially cover the Foundation types, founding levels and bearing capacity for the structures as identified in the project description and as shown in the drawings. The foundation types and founding levels shall be clearly identified.

Report shall also cover Safe Bearing Capacity and settlement analysis for shallow foundations, retaining walls and ground improvement techniques.

The report shall include commends on aggressive chemical content of soil and groundwater and recommendations for deciding level of protection necessary for concrete and steel buried parts.

CLAUSE A-4 VOID FORMER

Void formers are to be supplied with suitable end blockers to seal the void former ends.

Specialized form work shall be manufactured by use of form lining materials with ring stiffeners as per design requirements. The form lining shall be of Galvanized steel sheet of appropriate thickness (0.7mm) and the ring stiffeners should preferably be of structural steel sections. Manufactured void formers shall be absolutely leak proof.

The Void Formers shall be strong enough to withstand all pressure, ramming and vibration during placing of concrete and handling/erection stresses. The void formers shall be placed and tied in position so that they are not displaced during concreting.

All the steel surfaces shall be painted in accordance with Section 1900 of the Technical Specification, before use of Void Formers.

The contractor shall furnish the design and drawing along with detailed specifications of the proposed Void Formers for approval of Engineer before taking up the work.

Rate: The payment for void former shall be made in linear meters which shall include cost of supply, transport, fitting fixing in position and all other incidental expenditure complete in all respect as per specification & direction of Engineer.

CLAUSE A-5 PVC DOWNTAKE PIPE

1. Scope

The item includes supplying of PVC pipes with fittings of specified diameter including laying, fixing, cutting, jointing etc., for service duct or drain water pipe line.

2. Material

The pipes and fittings shall conform to series IV of IS 4985-1978. PVC pipes and fittings shall be free from cracks, flows and defects.

3. Construction Methodology

Before laying pipe line, it shall be first examined for damages and cracks. No cracked or damaged pipe and fittings shall be used in the work and they shall be removed from the site by the contractor at his own cost.

All the pipes and fittings shall be thoroughly cleaned with brush and washed if necessary to remove any accumulated stone, soil or dirt inside and outside surface.

The pipes shall be carefully laid straight to the correct alignment as indicated in the drawing. All pipes shall be used in standard length as far as possible. Cut length may be used only where it is necessary to make up exact length.

The pipe line shall be fixed in position as shown in the drawing or as directed by the Engineer.

The joining of pipes and fittings generally shall be done with approved make cement solvent including making surface rough. The pipe shall be cut to desired length. Care shall be taken that profile or cut surfaces shall not be changed and the fibrous material shall be removed with scraper or knife.

4. Measurement and Rates

The payment shall be made on running meter of pipe fixed in position. Unit rates includes,

i. Supplying of PVC pipes and fittings of specified diameter.

ii. Laying and cutting the pipe wherever necessary and wastage.

iii. Fixing the pipeline with GI clamps not less than 2 mm thick and GI nails length not less than 40 mm or with PVC clamps, screws, wooden guttiesetc.

iv. Making the solution joint.

v. All necessary materials, labour and used of tools required to complete the job.

The measurement shall be taken along the longitudinal axis centre to centre, which includes fittings, making joint etc.

CLAUSE A-6 TEMPORARY BARRICADE

1. Scope

(i) Arrangement of temporary barricade for enclosing the construction zone with traffic signals during construction at site, for day and night as per instruction of Engineer and drawings.

(ii) Once barricade has been provided and work started, removal of barricade is not permitted till completion of viaduct including construction of pile, pile cap, pier and pier caps. Erection of girders, segments till completion of entire super structure.

(iii) While erecting barricade, the bottom gap between barricade and road should be plugged with cement concrete from inside.

(iv) There should be minimum openings at the end of barricade to allow access of Lorries andmachine to site work area. Even these spacing should have proper opening/closing arrangements.

(v) Adequate blinking lights on barricade during night time must be ensured. The cost of this item should include provision for power pack/ Generator set etc. so as to ensure the blinking of lights in night time as long as barricades are in position at the work spot.

(vi) After completion of the entire work, the release barricades will be the property of the contractor and he is also responsible for shifting all such release materials away from the site. Barricade shall be constructed with MS Plate with 6mm thickness and 50mm X 50mm MS angle, all other materials, including cutting, transporting to site, fabricating, setting out, etc. complete as per drawing and MoRTH's Specifications Sections 1900 andas directed by Engineer.

(vii) Barricading may be required to be shifted laterally number of times but the same will be paid only once.

2. Payment

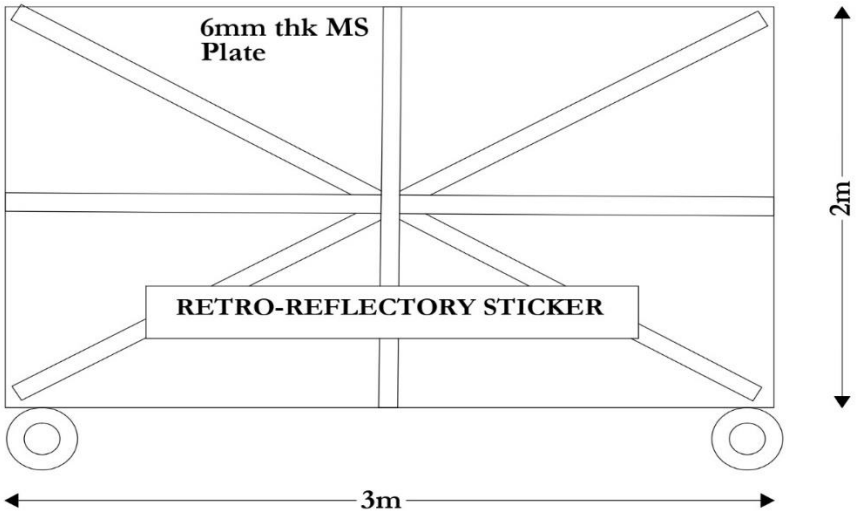
This item will be payable only at two stages of construction. First stage involves construction of foundations and substructures: (pile, pile cap & pier) and Second Stage: superstructure viaduct. In both the stages of construction, the barricading and arrangements for traffic diversion has to be kept continuously. Nothing extra will be paid for dismantling, shifting and re-erecting the barricades the traffic signals and other arrangements at the same place/stretch within the same stage. The construction of barricading will be limited to a width of 5.0m (outside to outside) of barricading for 2m height.

(Note: Barricading may be required to be shifted laterally number of times but the same will be paid only once).

The Payment schedule for item shall be as follows:

i) On completion of Piling, Pile cap, open foundation and piers as approved by Engineer 50% of accepted amount.

ii) After completion of all activities of Viaduct including removal of barricades and restoration of site with latest specification and as per the instructions of the Engineer, 50 % of accepted amount.



(Typical)